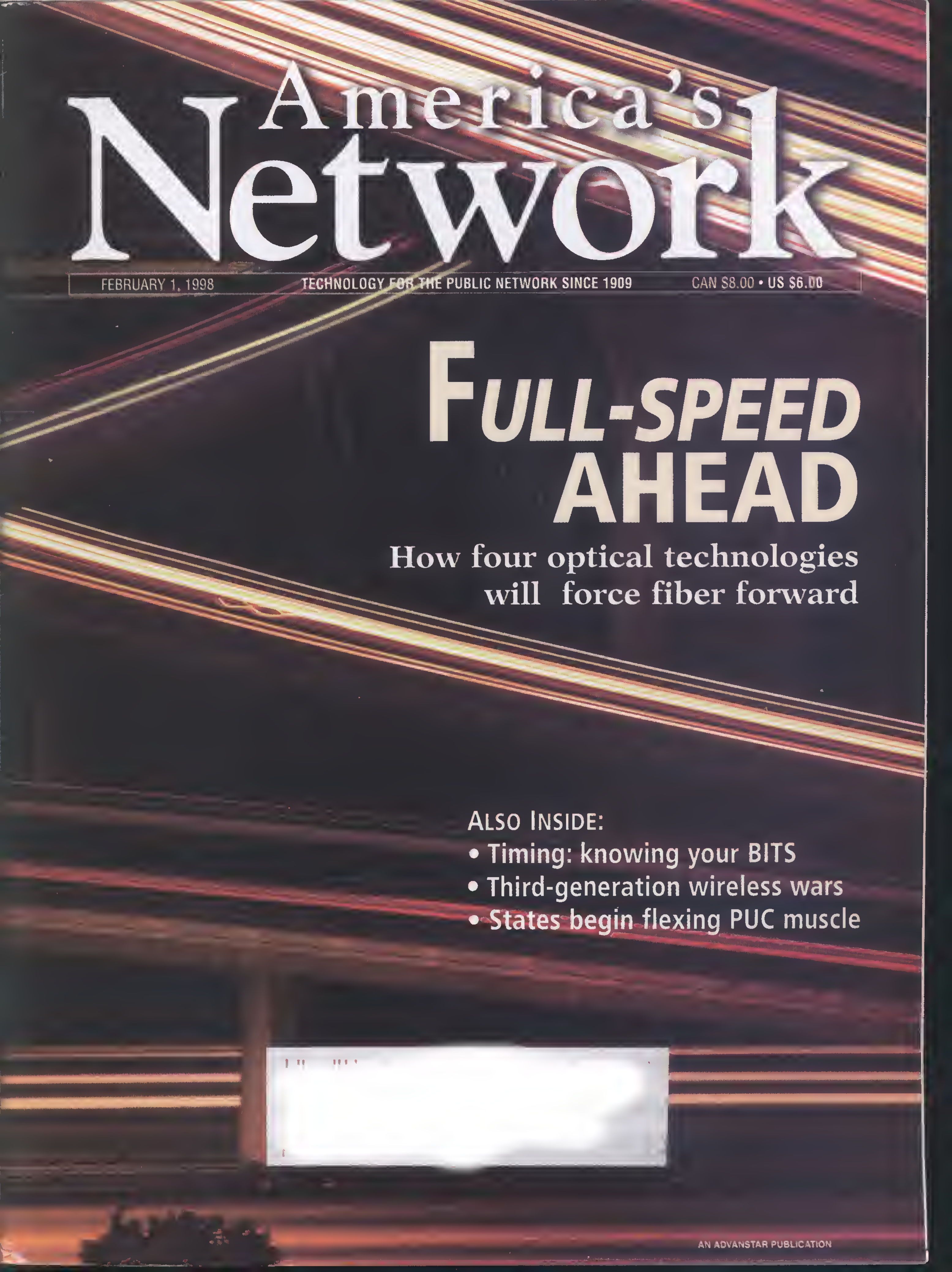

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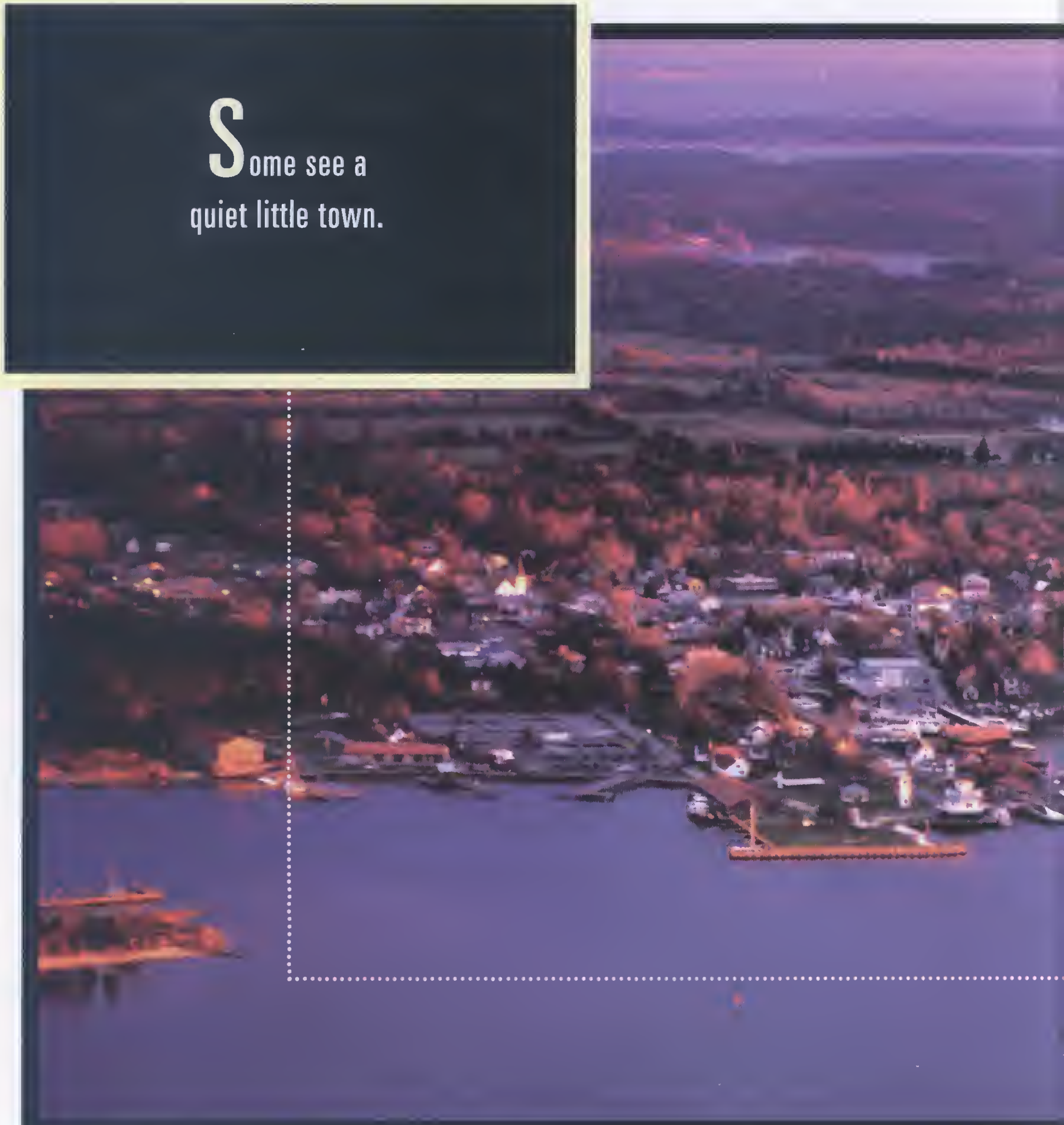

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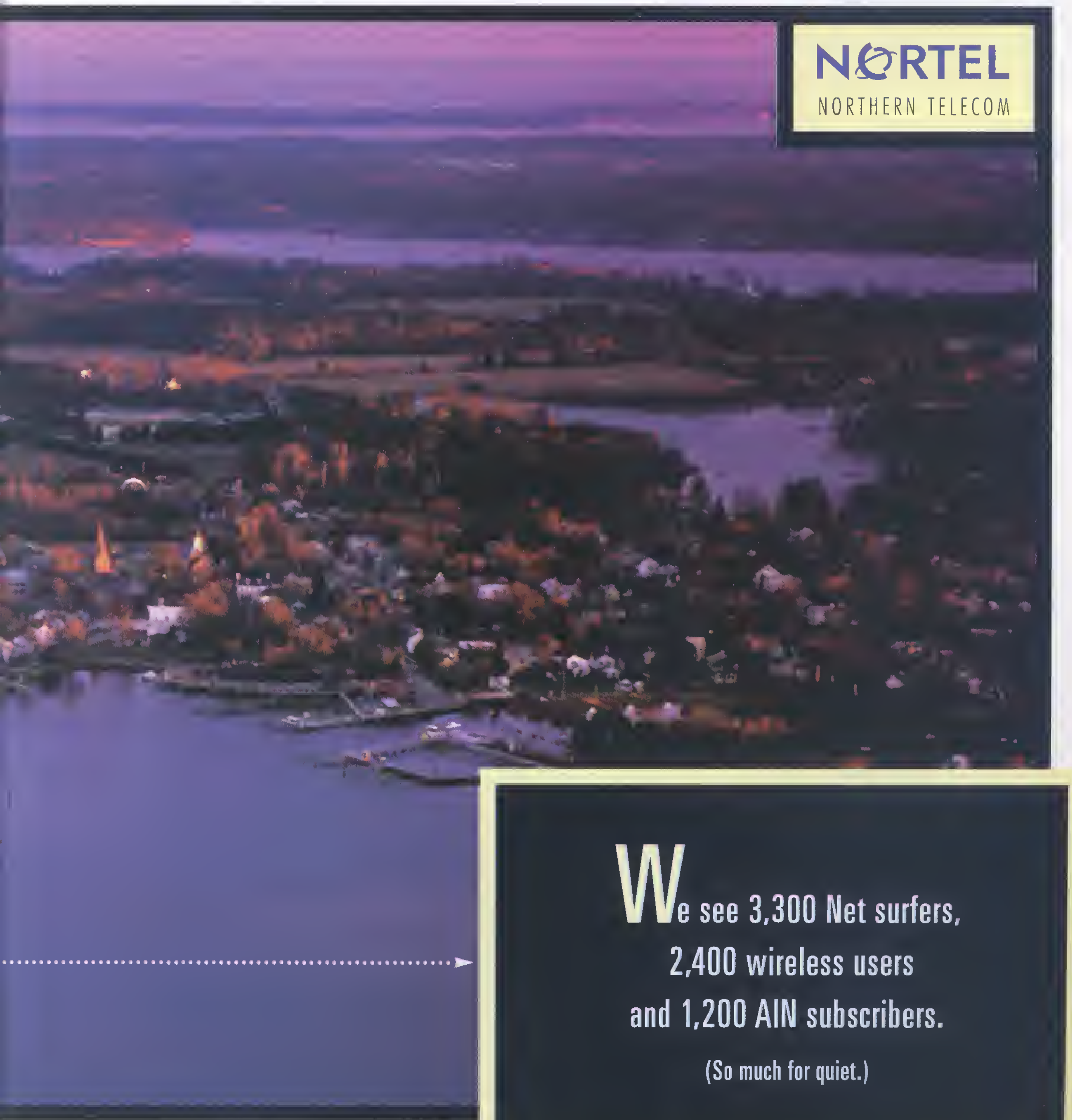

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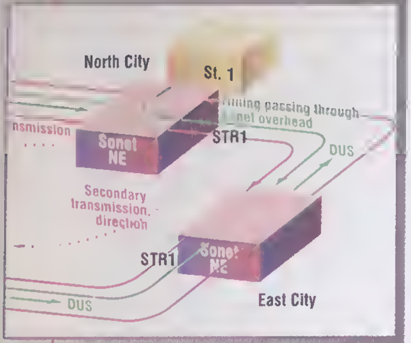
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Circle 101

From the Editors

ANNIE LINDSTROM

All-optical reality

I remember the first time I heard the phrase "photonic switching." It sounded so powerful and elegant—and expensive. Like many people in telecom, whose imaginations are captivated by the new and exciting, I became interested in the "all-optical network." And now I am encouraged by signs that it is starting to become a reality.

As our cover story, "Enabling the all optical network" (see page 14), points out, we are only in the early stages of its evolution. Nevertheless, recent discoveries have led to advancements in tuning, filtering and optical components that will make optical wavelength switching possible.

The all-optical network is one in which transmission, management and survivability will be achieved at the optical layer. Although wavelength division multiplexing (WDM) is prevalent in the nation's long distance networks today, and poised to emerge in metropolitan networks this year, optical wavelength switching won't become "truly viable for at least another five years," according to Mark Lutkowitz, president of research and consulting firm Trans-Formation Inc. (Birmingham, Ala.).

The first step toward optical wavelength switching is the deployment of programmable, optical add/drop multiplexers (OADMs), which will take at least two years to "build up steam," he adds. Trans-Formation's recently published *Optical Add/Drop Multiplexer Market Brief* projects that the U.S. OADM market will reach $55 million this year and slowly ramp up to $420 million in 2002. That's because incumbent and competitive local exchange carriers (ILECs and CLECs) will be the major buyers of this gear, and they have yet to deploy WDM in more than a limited fashion in their networks.

Bell Atlantic, which apparently faces a much more severe conduit/hard-structure-exhaust situation than its sister Bell companies, will announce a major WDM deployment this quarter, Lutkowitz says. The situation for other ILECs is not as pressing, and despite what vendors say, local carriers do not seem to be impressed with WDM pricing, he adds. It's quite possible that requests for proposals and trials will account for most of local market WDM activity for rest of 1998.

On the other hand, the mergers between WorldCom and MFS, and AT&T and TCG could accelerate deployment of WDM in the metro area. The locals may get a jump start because of their now easy access to WDM expertise.

In the meantime, standards bodies will work on interoperability issues; researchers and vendors will perfect network design, modeling and deployment strategies, which will one day let carriers offer their services via the optical layer; and regulators, ILECs and CLECs will debate whether or not "dark wavelengths" should be defined as a capacity/service or as a facility, which they could be required to lease to competitors.

Annie Lindstrom

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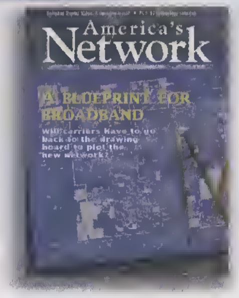
Circle 102

Satellite future


America's Network
A BLUEPRINT FOR BROADBAND
Will carriers have to go back to the drawing board to plot the new network?

Alan Stewart raises several excellent questions regarding the future design of the national and global information initiative (NII and GII) (see "A Blueprint for Broadband," Oct. 1, 1997).

Existing public and private networks are indeed a hodgepodge of products, technologies and protocols. The backbones are there for major league point-to-point traffic, but the trillion-dollar question of broadband to the masses still remains. We are talking about either a massive investment that no private non-monopoly entity appears willing to undertake (not even Bill Gates) or a government edict that won't happen in this new deregulated world of ours.

I am always eager to see how telecom executives are spinning the next one-size-fits-all solution for broadband delivery. The latest thinking goes like this: high speed cable will connect the home and some of digital subscriber line (xDSL) technology to businesses.

I often address the role satellites will play as a complementary technology to terrestrial wireline and wireless networks around the globe. I believe that broadband delivery is key to the future of satellites. The advantages of satellites in high-speed point-to-multipoint broadband delivery are often overlooked by the traditional wireline guys. Similarly, many satellite companies still think of themselves as non-consumer products. DIRECTTV has broken down that barrier and others like Iridium, Globalstar and Teledesic will soon follow.

But satellites will never be able to do it alone. Capacity constraints, signal attenuation and service availability will continue to present challenges to ubiquitous satellite service. Satellites must work with terrestrial systems—combining their advantages in distance-insensitive service with low-cost, high-speed terrestrial networks in high-density areas.

Clayton Mowry
Director
Satellite Industry Association

Correction:

A chart accompanying "Running the DSL numbers"(Jan. 1, 1998) beginning on page 34 was incorrect. Please visit our Web site at www.americasnetwork.com for the correct version.

Have something to
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Send your comments to Editor, *America's Network*, 201 Sandpointe Ave., Suite 600, Santa Ana, CA 92707; fax 714/513-8634 or e-mail at editors@americasnetwork.com. Comments may be edited for clarity and length.

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ROB NEWMAN

Redefining the access network

Public networks are about to run out of steam.

Carriers need a network that delivers the right combination of standards-compatibility, resiliency, bandwidth flexibility and low cost.

Data will be key to carrier profitability in the 21st century. In the next century, data services will provide 80% of carrier revenues, but will comprise only 40% of network traffic, says consulting firm CIMI Corp. (Voorhees, NJ). This implies that voice services will continue to represent the bulk of carrier traffic, but the rapid increase in Internet and other data applications will change the profitability assumptions around which carriers design their networks.

The explosion of the Internet clogged the phone company's voice dial-up networks and is forcing the industry to create new solutions that route data away from the switched voice infrastructure. This same problem is looming in the access network. Carriers' fiber access networks today transport broadband data services like transparent LAN as dedicated time division multiplexed lines. If this continues, the access networks will also run out of steam, crippling the carriers ability to support demand for data services.

Beyond the technical challenges that data creates, the carrier's profitability is also at stake. Data services represent high value to the business subscriber. Most businesses have invested significantly in LAN infrastructures to provide high performance data capabilities within their locations and understand the business benefits of data applications. They are looking to extend those benefits between their locations and to their customers and suppliers. But business customers are only willing to pay if services meet their business objectives. In competitive local markets, the carrier that can cost-effectively deliver a variety of data services will take a leadership position.

THE LAST INTERNET FRONTIER

The foundation of carriers' problems with data services can be understood with this typical question from a business subscriber: "I have 10 Mbps and 100 Mbps Ethernet running Internet Protocol (IP). Why can't I connect directly to the Internet with this?" Carrier and customer networks are separated by a chasm known as the access network, which knows nothing of IP. The problem is worsened since carriers can't deliver bandwidths that match the LAN traffic. Business users must throttle down to T1 (1.5Mbps) speeds or shell out for T3 (45Mbps).

It's clear, the metropolitan area networks (MANs) are the last Internet frontier. The MAN's synchronous optical network (Sonet) transport equipment delivers fixed bandwidth suitable for voice services and leased lines, but it's based on a rigidly structured time division multiplexing (TDM) hierarchy that can't efficiently handle the bursty nature of data or the needs of IP.

The mismatch between transport networks and data traffic results in large amounts of wasted bandwidth. Today's Sonet does not "understand" packets, and cannot groom data traffic for efficient transport and hand-off to the backbone network.

For example, provisioning a 10Mbps Ethernet service consumes an entire 52Mbps STS-1, wasting approximately 80% of fiber capacity. Each subscriber needs a dedicated hand-off port and additional network switching capacity to cross-connect data traffic. The net result of these limitations is that provisioning the broadband data services for today's businesses is cost-prohibitive and will rapidly exhaust fiber resources.

CHANGE FOR PROFITS

Building separate voice and data access networks is costly and inefficient. Putting more fiber in the ground further decreases profitability. Given today's competitive market, a solution must deliver higher profits over existing fiber and copper facilities. It must match LAN speeds, and address current and future packet data demands. Also, voice services are not ignored. This requires a fundamental change in the access networks.

The rigid TDM multiplexing layer that rides over Sonet is clearly an inhibitor. On the other hand, an asynchronous transfer mode (ATM) solution, operating over Sonet rings, delivers universal service transport. An integrated service access infrastructure will let carriers deliver a wide range of broadband data services while continuing to serve the voice market.

This change redefines the MAN, creating a network that delivers standards-compatibility, resiliency and most importantly bandwidth flexibility and low cost. With this, both the carriers and their business subscribers can reap the benefits of the new data reality. ■

Rob Newman is the CEO of Atmosphere Networks Inc. (Cupertino, Calif.).

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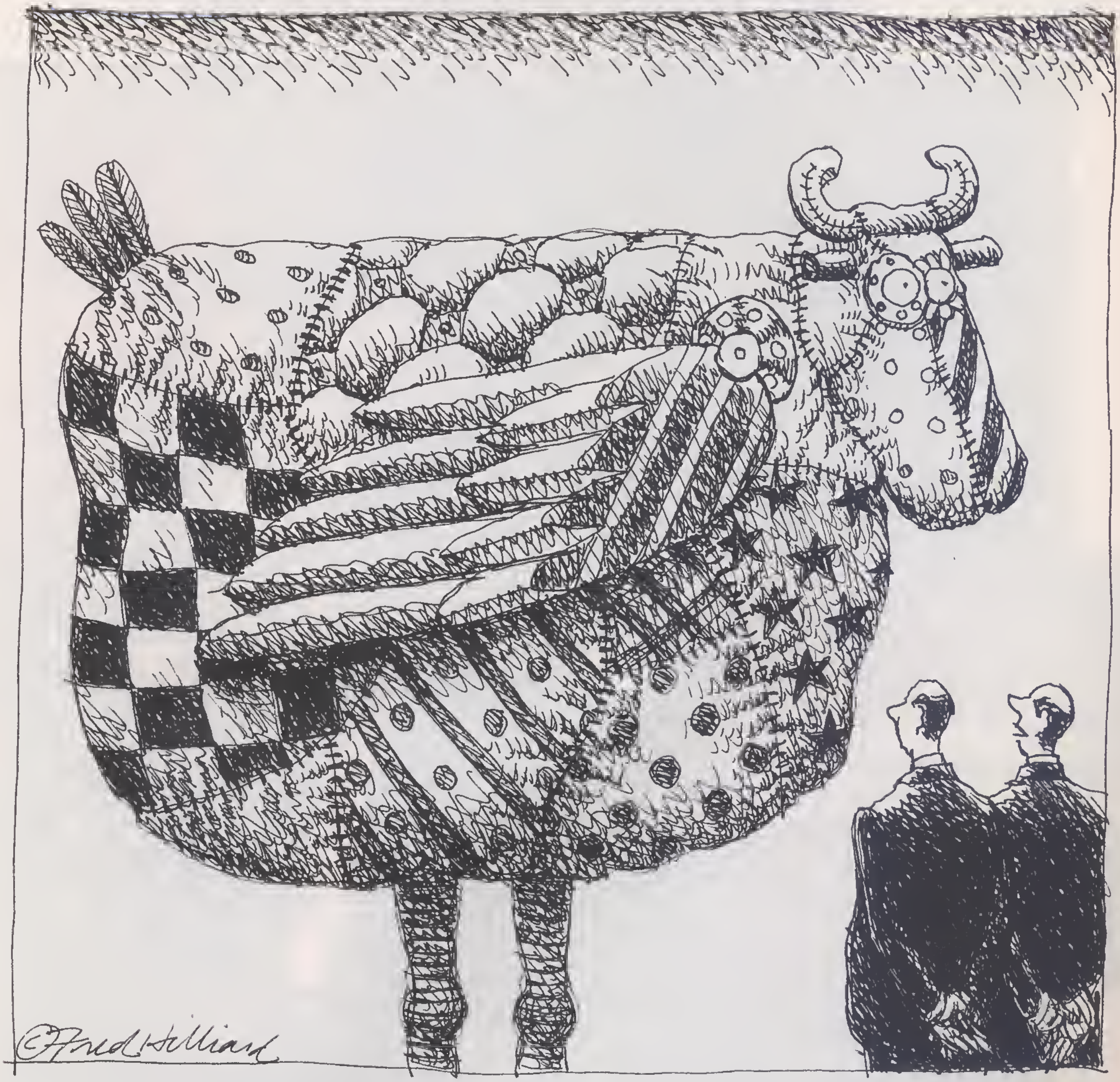

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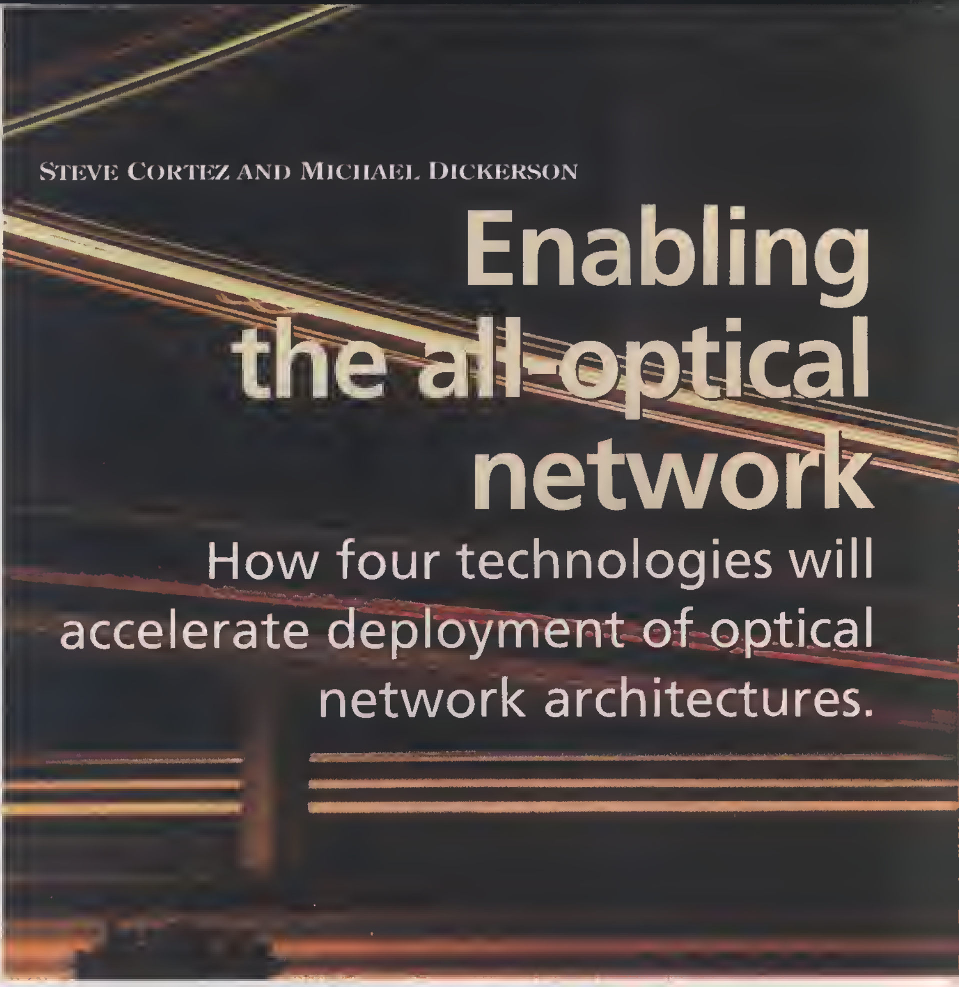


STEVE CORTEZ AND MICHAEL DICKERSON

Enabling the all-optical network

How four technologies will accelerate deployment of optical network architectures.

Significant advances in optical fiber components are accelerating carrier interest in design and deployment requirements for the all-optical network.

Initial carrier demand for higher capacity and longer-span distances is being addressed by the introduction of high-capacity wavelength division multiplexing (WDM) technologies. Further research and design evaluations will enable optical add-drop multiplexers (ADMs), optical cross-connects and optical switches to become reality in the telecommunications network of the 21st century.

A number of technology "enablers" are essential for designing and deploying the all-optical network:

- Arrayed waveguide grating;
- Acoustic optical tuneable fiber;
- Multi-wavelength substrate fabrication; and
- Wavelength translation.

STANDARDS

Significant challenges remain in the areas of standardization, design criteria and network modeling. Standardization efforts are just beginning to address optical network performance and interoperability issues; however, the telecom industry will benefit from first-generation optical network based on the synchronous optical network (Sonet) standard. Research laboratories have provided the first glimpse of optical network components that will be essential to complete end-to-end systems, and carriers have started to evaluate where and how these technologies can be integrated into their networks. The first successful deployments have focused on dense WDM (DWDM) elements.

With carrier demand for DWDM, the industry is renewing the deployment challenges it faced when early Sonet technologies emerged: scalability, interoperablity, span design and network management. Solving these challenges is key to successful introduction and deployment of the all-optical network architecture.

The standardization process for all-optical networking made significant strides when the International Telecommunication Union (ITU; Geneva) agreed on a 100 GHz grid for selecting wavelength. The reference frequency will be at 193.1 THz, as outlined in ITU-T draft Rec. G.mcs and in Bellcore's GR-2918-CORE; the wavelength frequency grid begins at 1532 nanometers (nm) and ends at 1563 nm.

Standards committees are evaluating more specific recommendations that will enable optical performance characteristics to be defined in detail. Driving concerns are issues related to laser tolerances, line width, signal-to-noise ratio and crosstalk levels. Coupled with requirements for specific channel implementations for eight, 16 and 32 wavelengths, the industry has yet to define a level playing field for true optical signal interoperability. These criteria will govern the ultimate scalability and survivability of the all-optical network.

The American National Standards Institute (ANSI; New York) has established working groups in Committee T1X1.5 to define network elements in the optical layer. General and functional requirements are also being reviewed based on initial recommendations in G.onp, "Physical Layer Aspects of Optical Networks" (Q.16/SG15). The biggest challenge for these working groups is to address the level of transparency to which the all-optical network will have to conform. With an embedded infrastructure of asynchronous and Sonet technologies, the interoperability criteria for vendors could outweigh cost/benefit requirements.

Additional areas being incorporated into optical network standardization efforts include:

- Frequency plans for metropolitan applications;
- Parameters for "edge interfaces"; and
- Physical layer aspects for intercarrier, intracarrier, multichannel, single channel and multivendor interfaces.

Network management requirements transcend all of these challenges. The standards groups emphasize the open systems interconnection (OSI) model to enable transparency and/or mediation between a variety of client signals (Sonet, asynchronous, etc.). They also are developing a standardized information model between clients so element management control and provisioning can traverse multivendor environments.

DESIGN PARAMETERS

To deploy a pure, optical network, carriers will have to understand a new set of design parameters and associated performance criteria. These parameters include optical non-linearities, loss/gain imbalance, signal-to-noise ratio, chromatic dispersion and polarization mode dispersion (PMD) effects. The ability to measure and model the effects of these parameters will be essential.

Designing an all-optical network architecture will impact carriers in two ways: they will either have to expand their existing networks or build brand new networks. For existing networks, the biggest challenge will be in characterizing the optical "health" of existing fiber plant. Key issues to consider include span distance, the ability to mix time division multiplexed (TDM) signals (OC-48/OC-192), PMD effects on OC-192, propagation on dispersion shifted fiber, and support for a huge embedded base of asynchronous signals.

Thanks in part to significant advances in fiber optic cable design, carriers building new networks can design them to accommodate next-generation TDM signals while deploying currently matured systems. Without significant optical network interface standardization, network span design still can impose certain challenges based on equipment design implementations, such as how the equipment supplier maintains the signal-to-noise ratio and power across multiple wavelengths.

Ideally, carriers would be able to use the available system margin to implement a variety of span designs—for example, 5 km x 120 km., 4 km x 140 km., and 6 km x 100 km. To provide this level of flexibility, the signal-to-noise ratio and power attributes of all wavelengths incorporated with an optical amplifier design must be maintained across a flat gain spectrum.

Recent carrier experiences have exposed two primary optical amplifier designs. One approach relies on a worst-case, ultimate-capacity design which, regardless of number of incoming signals, drives the amplifier into optical power saturation. All wavelengths are essentially "on" and the gain spectrum is normalized at its ultimate capacity. This configuration is susceptible to transient spikes incurred when optical signals are removed or re-inserted.

The second approach relies on recently introduced automatic gain control (AGC) functionality to maintain the signal-to-noise ratio and power attributes on a per-wavelength basis. As optical signals are input, AGC circuitry enables the system to maintain the required signal-to-noise ratio and power within the gain spectrum. Individual wavelengths are turned "on" and the optical amplifier can be configured to provide just enough power to support a single wavelength.

Consequently, the amplifier is not constantly at saturation, which affects long-term amplifier stability and end-of-life issues. The design is suited for dynamic carrier implementations in which wavelength re-allocation and diverse span designs are essential for competitive network applications.

NETWORK MODELING

High performance and discrete tolerance criteria for a new generation of optical fiber components will necessitate new measurement and testing techniques. Design tools that verify and validate component and overall system design will be required. The resultant criteria then can be incorporated into new network modeling and simulation software, which will enable carriers to implement appropriate network capacity and span designs.

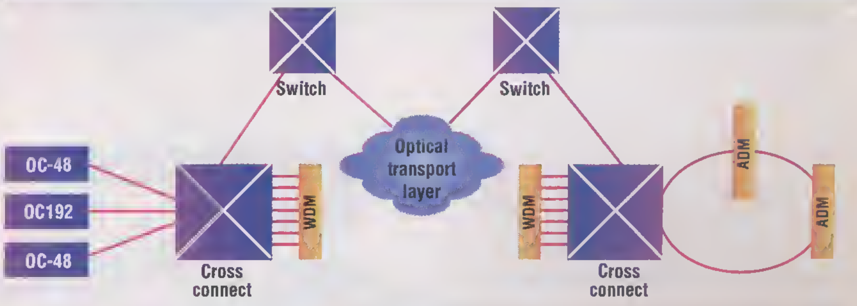
As optical network elements such as WDM systems are deployed, the first objective for network planners is to make their designs survivable and cost-effective. Planners must merge two known entities:

- Network data—including network topology (number of adjacent nodes of each span with distance) and network loading (number of lightwave channels required by each demand pair); and
- Physical parameters—fiber count per span, number of wavelengths per fiber, and the matrix size of the optical switch.

To optimize use of optical layer components, the following items must be incorporated into the modeling tool:

- Span—number of wavelengths, number of fibers and wavelength miles;
- Node—number of optical switches, wavelengths and fibers; and
- Channels—hops and distance of working and/or restoration channels.

Figure 1: Optical network architecture



Source: NEC

Table 1. Technology enablers

Network element	Enabling technology	Network deployment
WDM	Arrayed waveguide grating	Local & long distance
Optical ADM	Acousto-optic tunable filter	Local & long distance
Optical cross-connect	Multi-wavelength substrate fabrication	Optical network layer
Optical switch	Wavelength translation AOTF	Optical network layer

Source: NEC

The real challenge of network planners will be to normalize the results of this data against today's traditional TDM-based solutions. The prime unknown factor for optical network components will be cost. WDM systems are just being deployed and have not matured enough to normalize long-term mean time between failure (MTBF), maintenance, stability and quality of service factors, all of which are fairly well established for today's TDM based networks.

DEPLOYMENT STRATEGIES

Successful deployment of high-capacity WDM systems incorporating up to 32 channels of OC-48 signal transmission ushers in a new, pure-optical layer in today's telecommunications infrastructure. Optical network technologies will impact carriers' decision criteria high-capacity, Sonet-based TDM systems.

These network planning issues are being expanded to include long-range forecasting of the next optical elements to be introduced in accordance with the evolution of the all-optical network, including optical ADMs, optical cross-connects and optical switching elements. Combined, these elements will enable carriers to establish an optical network architecture (Figure 1, Table 1, page 15).

These elements will let carriers introduce the ultimate network application based on an all-optical network architecture: wavelength service. The ability to re-use and re-allocate wavelengths in a network environment that has more users than available wavelengths is diversely beneficial. The ability to reconfigure due to congestion or possible link failure is a constant demand on any carrier network. Virtual networks can be configured from network management systems that allocate wavelengths on a local or global scale. Ultimately, wavelength service will define a carrier's ability to define and implement true optical network interface interoperability across multivendor and multicarrier environments.

ARRAYED WAVEGUIDE GRATING

Arrayed waveguide grating (AWG; see Figure 2), is a special configuration of existing waveguide fabrication technology that provides efficient multiplexing and demultiplexing of optical signals. AWG is based on the same principle as a phased array antenna, in which the signal converges at appropriate points in space, depending on the frequency. Appropriate uncoupled waveguides then are placed at that point in space.

The AWG component can operate in a high diffraction order, which leads to high wavelength resolution. Thus, multiplexing and de-multiplexing selective wavelengths can be achieved at the respective input and output waveguides. Waveguide fabrication has matured to deliver low propagation loss and efficient coupling to fibers. Coupled with compact design and inherent ADM functionality, AWG provides enhanced functionality in current implementations of WDM technology.

ACOUSTO-OPTIC TUNABLE FILTER

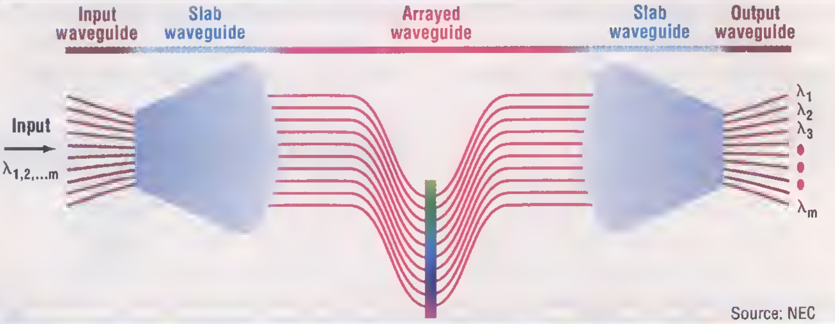
Radio frequencies (RFs) that are launched into the acousto-optic tunable filter (AOTF) design to generate surface acoustic waves to switch and/or select wavelengths. These RF controllers can be managed by remote provisioning, which enables selective add/drop capabilities at existing regenerator sites.

The AOTF is based on the elasto-optic effect, in which a material strain causes a change in the refraction index of the material. When the strain is generated by an acoustic compression or rarefaction, an AOTF is formed. Because the acoustic signal is sinusoidal, a moving refractive index grating is formed in the device. Like a permanent grating, the various wavelengths are spatially diffracted and separated from each other. With an output coupler placed at the appropriate diffraction order location, tunable filtering can be achieved.

Research has demonstrated that the AOTF can provide multiple wavelength filtering in a single device. In addition, multiple RF signals can be generated, enabling access to a number of optical wavelengths—a unique capability among filter designs.

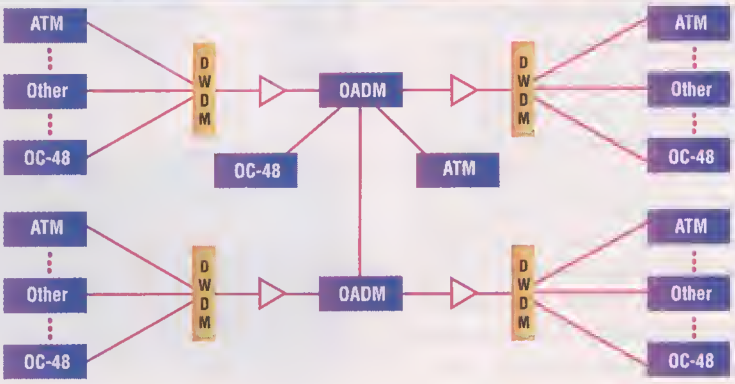
Applying this technology to current WDM regenerator sites will enable an optical ADM function to be performed, whereby individual or multiple wavelengths can be selected and interfaced with other terminal equipment (Figure 3).

Figure 2: Arrayed waveguide grating



Source: NEC

Figure 3: Optical ADM functionality



Source: NEC

MULTI-WAVELENGTH SUBSTRATE FABRICATION

The ability to design and deploy an optical network layer hierarchy has been limited by the current conventional process—that all lasers on a wafer have the same emission wavelength and lasing characteristics. Thus, wavelength selection required a pre-determined and expensive cascading of filter technologies. Accordingly, extensive wavelength-selective routing and add/drop capabilities were envisioned to provide rigid provisioning capabilities—with costly implementations.

Research has identified an enabling technology to manufacture diode lasers with different emission wavelengths on a single wafer. The development of made-to-order, simultaneous fabrication of different wavelength diode lasers on a single wafer let carriers match the pre-assigned wavelength grids of current and future WDM systems. Each diode laser with a different wavelength must demonstrate uniform performance characteristics over a wide range of erbium doped fiber amplifier (EDFA) gain bandwidth of 1530 nm to 1560 nm. Researchers have achieved arbitrary wavelength control of a distributed feedback laser by controlling the grating pitch to increments of less than 0.01 nm.

WAVELENGTH TRANSLATION

The first generation of optical switching has demonstrated that filter technology will enable a pre-determined wavelength frequency to be selected at one port and switched to another. The second port must contain filter technology to support the exact same wavelength frequency as the incoming one. For optical switching technology to evolve so it can support the same type of payload transparency seen in today's cross-connect systems, wavelength translation must be incorporated.

Wavelength translation functionality relies on the evolution of filter technology to support dynamic provisioning of multiple wavelengths. As outlined previously, research findings have announced that multiple wavelength fabrication can be performed on a single substrate. One enabling technology thus bears promise for wavelength translation to be incorporated into optical switching elements.

By enhancing the optical switch with wavelength translation, a wavelength λ_1 can be selected at port 1 and then switched to wavelength λ_2 at port 6. This lets optical switching technology deliver the payload transparency demanded by carriers. ■

Steve Cortez is manager, product planning, and Michael Dickerson is a product manager for NEC America Inc. (Herndon, Va.).

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BROADBAND

AUSTIN LESEA

Knowing your BITS

The costs and maintenance factors of various synchronization distribution architectures.

WHEN PLANNING SWITCHING AND TRANSMISSION NETWORKS, CARRIERS MUST CONSIDER TIMING AND SYNCHRONIZATION ISSUES. FIVE COMMON ARCHITECTURES ARE USED FOR SYNCHRONIZATION AND TIMING; THESE INCLUDE:

- Conventional asynchronous transmission and transport architecture, using Building Integrated Timing Systems (BITS), or "clock" systems;
- Synchronous optical network (Sonet) with BITS;
- Sonet with synchronization messaging with or without BITS;
- Sonet with synchronization via conventional asynchronous transmission and BITS; and
- Global positioning system (GPS)-derived timing for Sonet systems.

There are other architectures; however, they usually are some combination of the ones just described.

ARCHITECTURAL CHOICES

Conventional hierarchy. The conventional architecture is commonly used by local exchange carriers (LECs) and is described in current industry standards for synchronization and timing. The conventional synchronization plan starts at a primary node with a triple-redundant set of Cesium clocks. Cesium clocks provide a reference that is standardized as Stratum 1—which is less than 1x10–11 error in frequency at any time. While Cesium clocks meet this standard, GPS-referenced rubidium clocks have been shown to achieve better than 1x10–12 in frequency at any time.

The primary node is where all network elements are timed from the Cesium clock. Lower level clocks are used for holdover, in case the terrestrial transmission links to the primary nodes fail. At the first level below the Cesium clocks are the Stratum 2 BITS clocks, having a 1x10–10 per day holdover stability. These clocks are used at toll centers. Below the Stratum 2 BITS clocks are the Stratum 3 BITS clocks, which have less than 255 slips in 24 hours and are used in Class 5 central offices (COs). Further out—at the customer's site—are Stratum 4 clocks, which are integrated into channel banks or customer premises equipment (CPE). Stratum 4s provide no holdover; rather, they smooth out jitter and wander, providing a clean clock source for transmitted data flowing from the customer site into the network.

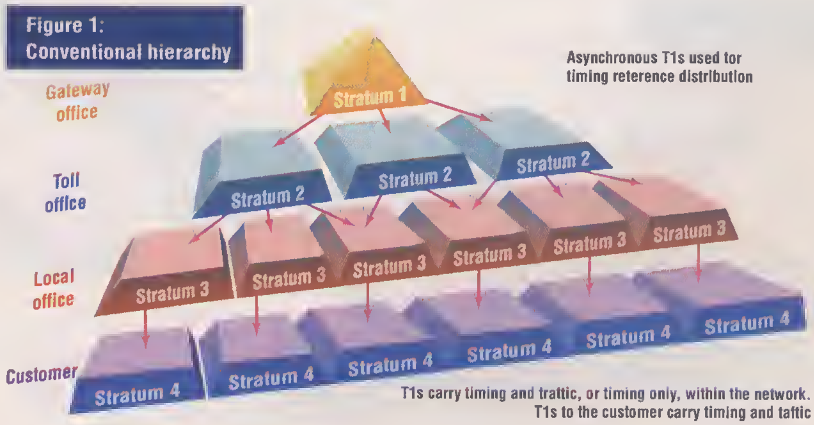
The conventional system works only with asynchronous transmission equipment, not with Sonet. The system provides a grade of service and availability that is consistent with the prevailing voice-traffic services it supports. Even Stratum 1 timing sources have routine 648 nanosecond (ns) hits associated with reference switching—this is not allowed under the new clock requirements for Sonet. BITS clocks are low quality, and have transients that exceed today's Sonet requirements (Figure 1).

Sonet distribution with conventional hierarchy. When Sonet was introduced, the ability to transport timing using the optical line overhead initially was seen as a great benefit. Unfortunately, ring topologies complicate matters. In addition, the low quality of Stratum 3 holdover prevents it from being used with Sonet systems. This has prompted the industry to develop a new Stratum 3E standard with less than a 1x10–8 per day error and a well-defined, short-term, phase noise output specification.

A Sonet transmission system distributes synchronization with the head-end of a Sonet chain, or the "top" of a Sonet ring timed from a higher quality Stratum clock. Subsequent nodes use line-timing to drive local lower-quality Stratum clocks. Stratum quality is best at "1" (the lowest number) and worst at "4" (the highest number).

Hierarchical BITS are used at each node; they take the line-timing from the Sonet multiplexer, smooth it out and return it to the mux. The multiplexer then can be used for line timing that

Figure 1: Conventional hierarchy



Asynchronous T1s used for timing reference distribution

T1s carry timing and traffic, or timing only, within the network. T1s to the customer carry timing and taffic

Source: Larus Corp.

continues on downstream or around the ring. Special care must be taken to create a ring that cannot be configured to take timing from itself, which creates a timing loop (Figure 2).

Sonet distribution with synchronization messaging. In the event of a fiber failure, a ring may rearrange itself to transport traffic; however, it may be unable to find a good timing source without creating timing loops. While the ring reconfigures, it may not be able to deliver service. One way out of this dilemma is to use a BITS clock at each Sonet node. Another way is to use synchronization status messages (SSMs) which allow the ring to reconfigure its timing.

BITS clocks still are used frequently to bridge the time it takes a ring to find a good source of timing. In such intervals, the Sonet node operates from its internal Sonet maintenance mode clock, if no other clock is used. The resulting quality level, while above Stratum 4, is below Stratum 3 and does not guarantee traffic transport (Figure 3).

Sonet timed from conventional hierarchy. Faced with such problems, many networks use the existing asynchronous network to transport timing signals to BITS clocks at the Sonet nodes. This is an overlay of two technologies, and an interim topology. It's problematic, because the BITS clocks that are used are frequently of the older variety, and may not be stable enough to prevent excessive pointer adjustments by the Sonet nodes (Figure 4).

GPS-derived timing and synchronization. The above situations faced by carriers changed as soon as products became available using information continuously transmitted by the GPS satellite constellation to discipline clocks. No terrestrial distribution would be required; every node could derive timing independently from a GPS reference.

Holdovers of the Stratum 3E or Stratum 2 quality levels are available on many of these clock systems, as they can use external T1 references should an antenna or GPS receiver fail. In most failure scenarios, internal line timing can be used, thus eliminating the cost of redundant GPS. (Figure 5).

DIRECT COSTS

The conventional approach is probably the least expensive in terms of direct equipment costs. Stratum 3E clocks are not required to keep any part of a network operational. In addition, use of asynchronous transmission facilities is a well-known, well-understood methodology.

Sonet-based systems add immediate direct costs, because Stratum 3E clocks or better BITS clocks are required at every node. In some cases, direct costs increase when existing asynchronous transport is used for timing.

The GPS timing model increases costs, because a GPS BITS clock is placed at every node, and associated cabling to the GPS antenna outside must be installed. Early GPS systems needed to view at least four satellites to operate properly, and antennas required an unobstructed view of the sky. However, newer GPS systems need to view only one satellite, and even can operate through a window on the side of a building—suitable for urban applications.

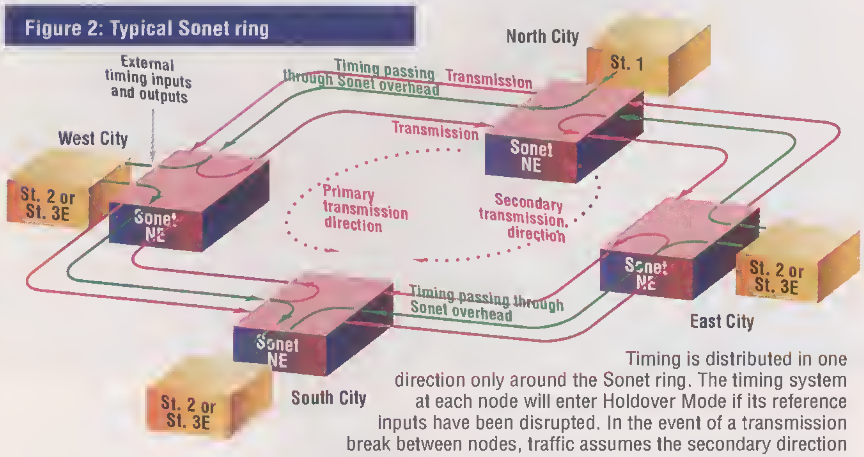
INDIRECT COSTS

The conventional model has one hidden cost: the loss of revenue caused by the use of transport that otherwise can be made available for network traffic.

Sonet models have few hidden costs. Only the use of existing asynchronous links results in lost revenues. Existing derived DS1s may be used for timing distribution; however, pointer adjustments and other impairments make this a rarely used option.

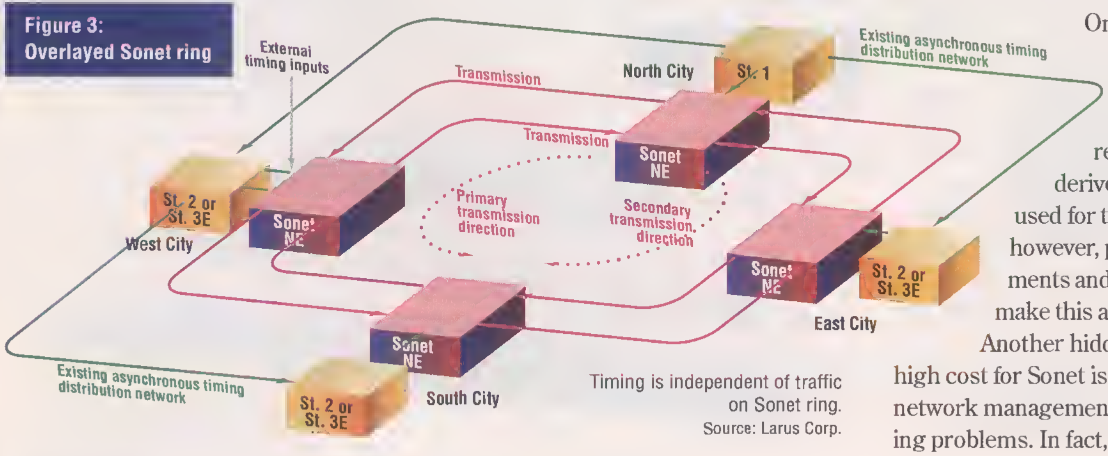
Another hidden and potentially high cost for Sonet is the need to have a network management system for locating problems. In fact, the maintenance

Figure 2: Typical Sonet ring


North City
St. 1
External timing inputs and outputs
Timing passing through Sonet overhead
Transmission
Transmission
West City
St. 2 or St. 3E
Sonet NE
Sonet NE
Primary transmission direction
Secondary transmission direction
Sonet NE
St. 2 or St. 3E
Timing passing through Sonet overhead
Sonet NE
East City
St. 2 or St. 3E
South City

Timing is distributed in one direction only around the Sonet ring. The timing system at each node will enter Holdover Mode if its reference inputs have been disrupted. In the event of a transmission break between nodes, traffic assumes the secondary direction and is maintained while in holdover until the break is repaired.
Source: Larus Corp.

Figure 3: Overlayed Sonet ring



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I ○ Independent Cable TV System
J ○ Cable TV Contractor/Engineering Firm
K ○ Other Cable
L ○ Competitive Access Provider (CAP)
M ○ Telecommunications Reseller
N ○ Internet Service Provider/Commercial Online Service Co.
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D ○ **Cable/Video/Multimedia Equip./Services** (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
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J ○ **Other** *(please specify)* ________
K ○ None of the Above (A–J)

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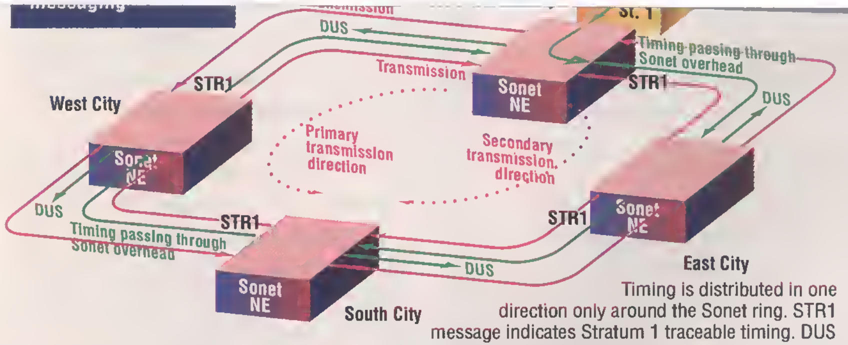

DUS
Transmission
Timing passing through Sonet overhead
STR1
DUS
West City
Sonet NE
Sonet NE
Primary transmission direction
Secondary transmission direction
STR1
DUS
STR1
Timing passing through Sonet overhead
Sonet NE
STR1
DUS
Sonet NE
East City
South City

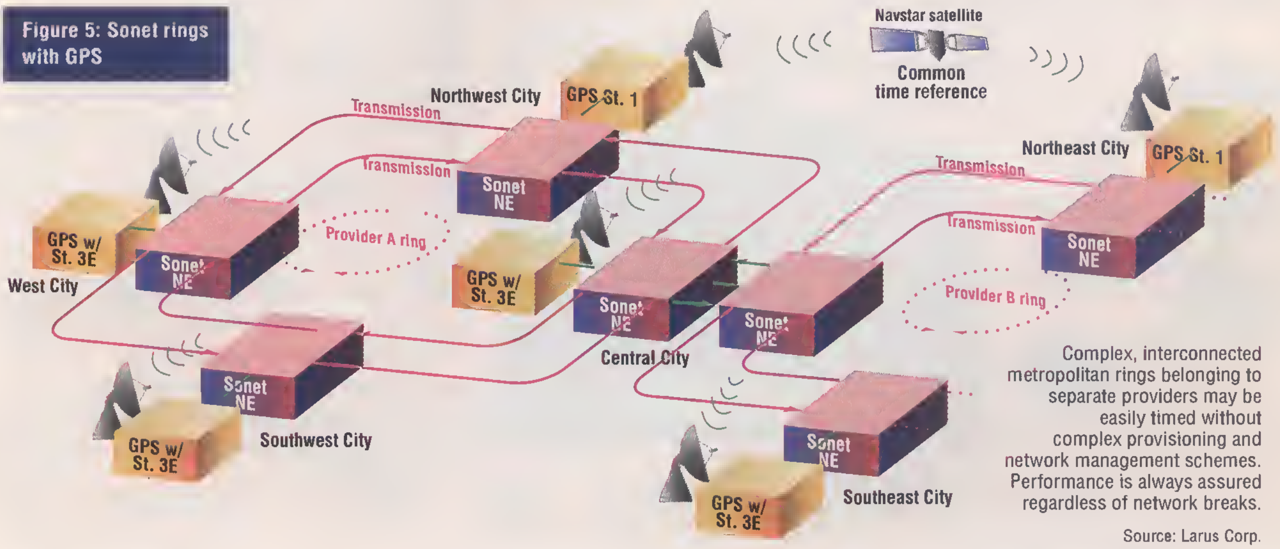
Timing is distributed in one direction only around the Sonet ring. STR1 message indicates Stratum 1 traceable timing. DUS message indicates "don't use" timing. In the event of a fiber break, traffic and timing are automatically rearranged. The arangement may take a minute or more to complete. BITS clocks may be used at each node as in the typical Sonet ring if rearrangement causes unacceptable service problems.

Source: Larus Corp.

tems, but all can derive benefits from network management. Some networks are excessively complex and fragile, and do not deliver the expected grade of service. Under failure conditions, some networks are more robust than others, but generate hidden costs associated with antennas, network management systems or perhaps BITS clocks at every Sonet node. ■

Austin Lesea is vice president of advanced product development and a director of Larus Corp. (San Jose, Calif.)

Figure 5: Sonet rings with GPS



Complex, interconnected metropolitan rings belonging to separate providers may be easily timed without complex provisioning and network management schemes. Performance is always assured regardless of network breaks.

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Sonet models have few hidden costs. Only the use of existing asynchronous links results in lost revenues. Existing derived DS1s may be used for timing distribution; however, pointer adjustments and other impairments make this a rarely used option. Another hidden and potentially high cost for Sonet is the need to have a network management system for locating problems. In fact, the maintenance

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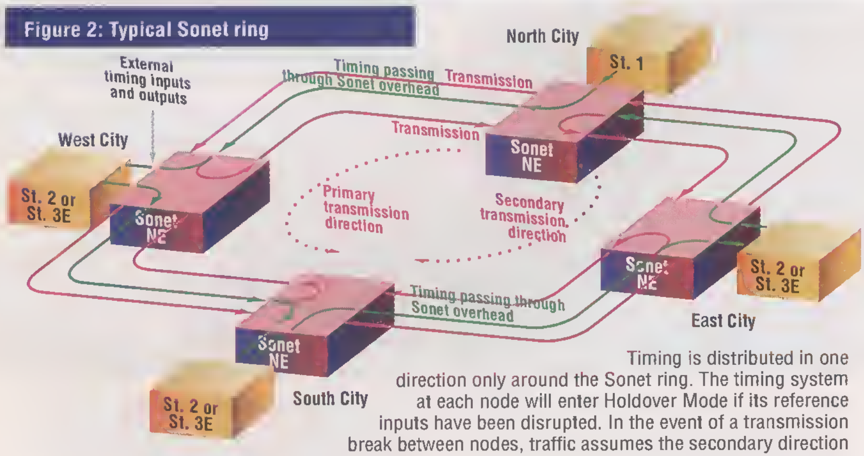
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Source: Larus Corp.

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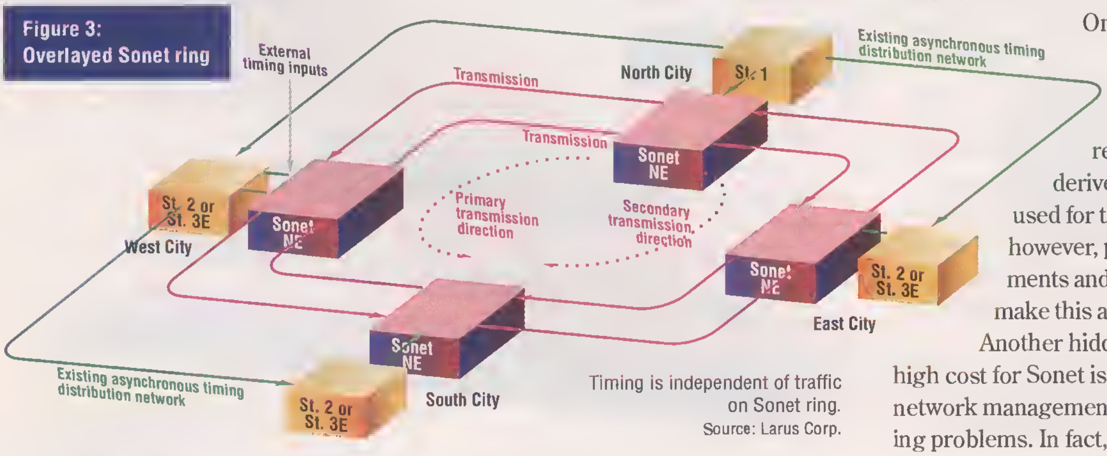


Timing is independent of traffic on Sonet ring.
Source: Larus Corp.

and upkeep of such management systems may be more costly in some instances than the Sonet network itself.

The GPS model has no indirect costs; the satellite system is federally maintained and reception is free.

OPERATION AND MAINTENANCE

The conventional system, because of its hierarchy, can be operated and maintained simply. Troubleshooting is performed with conventional problem-locating tools on the transport part of the network. In such cases, technicians carry travel cases with portable Cesium or rubidium oscillators, used to identify synchronization and timing troubles. Although the architecture is labor-intensive when identifying trouble, it is simple to understand. Maintaining proper records is key in identifying facilities used for timing distribution.

When a Sonet system fails, it still may be difficult to find qualified personnel to locate and identify the problem. Sonet architectures typically have prolonged troubleshooting intervals; in addition, transport services may be disrupted during an outage. Timing systems with built-in test and measurement, such as synchronization performance monitoring using automatic threshold crossing alarms, work with network management systems to identify trouble-spots. Two factors make finding and tracing circuits in a Sonet network difficult: the need for automatic record-keeping; and problems associated with Sonet add/drop and insert capabilities.

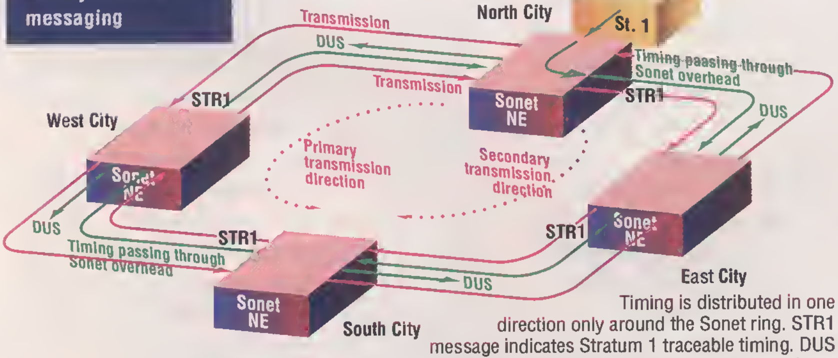
To ensure a high level of network availability, many Sonet systems use a large number of Stratum 2 BITS clocks to enable repairs during working hours. Unfortunately, Stratum 2 BITS clocks typically use rubidium-based oscillators for long holdover stability (more than a month to the first slip). Rubidium oscillators exhibit wear-out symptoms in less than 15 years. Some timing systems have rubidium devices that require calibration or repair every seven to 10 years.

GPS timing systems are independent. Each system operates until it enters a holdover or failure mode. A far simpler network management system is needed to find nodes not in GPS mode, and only those nodes need to be configured to take other sources of timing (such as Sonet line timing) until the fault is fixed. If the GPS timing equipment can automatically fall back to a DS1 reference or has suitably high holdover stability, then faults will not cause service outages. There is time to repair the fault during normal working hours, not during weekends or evenings.

All architectures use BITS clocks to some extent. Not all systems need large or complex network management systems; but all can derive benefits from network management. Some networks are excessively complex and fragile, and do not deliver the expected grade of service. Under failure conditions, some networks are more robust than others, but generate hidden costs associated with antennas, network management systems or perhaps BITS clocks at every Sonet node. ■

Austin Lesea is vice president of advanced product development and a director of Larus Corp. (San Jose, Calif.)

Figure 4: Sonet ring with sync status messaging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STR1
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Sonet NE
South City

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Source: Larus Corp.

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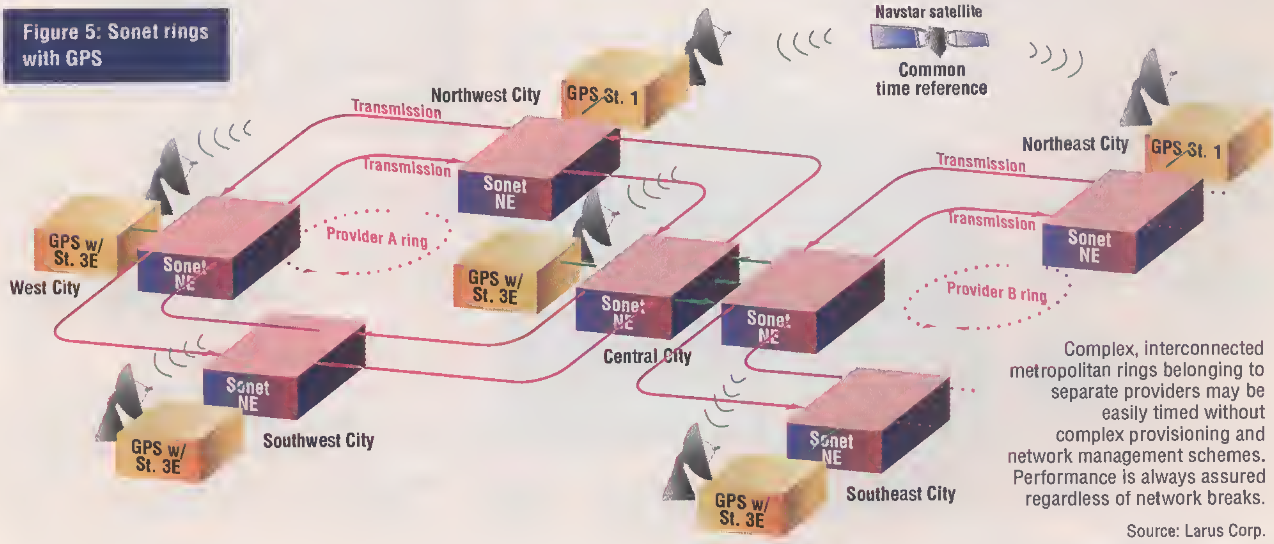


Complex, interconnected metropolitan rings belonging to separate providers may be easily timed without complex provisioning and network management schemes. Performance is always assured regardless of network breaks.

Source: Larus Corp.

BROADBAND Notebook

ANNIE LINDSTROM

PSSSSST.......

Keeping a secret is difficult, especially a good one. Just ask the folks at **Paradyne** (Largo, Fla.), who last week finally got to unlock their lips about a product which had been under development for the past 20 months.

Paradyne unveiled the MVL (multiple virtual lines) modem last week at ComNet'98 in Washington, D.C. The vendor developed MVL technology from scratch specifically to support applications that asymetrical digital subscriber line (ADSL) technology was designed to support as well as to jump the hurdles that Paradyne says stand in the way of ADSL's mass deployment.

The announcement was something of a surpise for xDSL market watchers. That's because the core technology of the vendor's flagship HotWire product portfolio is ADSL. Those in the know, however, have heard Paradyne executives clearly state their view that ADSL and rate adaptive DSL (RADSL) are best suited for the business market, not the mass residential market (*America's Network*, "Can local loops handle ADSL?," June 15, 1997).

Problems standing in the way of mass ADSL/RADSL deployment include limited loop reach, hefty power requirements, overall cost, cross-talk, remote terminal challenges and in-house wiring, explains Frank Wiener, vice president of Paradyne's DSL products division. Despite these drawbacks and the introduction of MVL technology, Paradyne expects to keep selling ADSL products into the business market, where the business case for ADSL/RADSL is much more solid.

"ADSL was a video dial-tone specification and when the application changed to data, no one changed the transceiver. It has all kinds of baggage left over from the requirements of broadcast quality video that is of no use for applications such as Internet access, remote LAN access, video conferencing, etc. So we started with a clean sheet of paper and looked at the applications and started from scratch," Wiener.

The first version of the MVL modem, which will ship in the March/April time frame, provides end users with 768 kbps connectivity upstream and downstream.

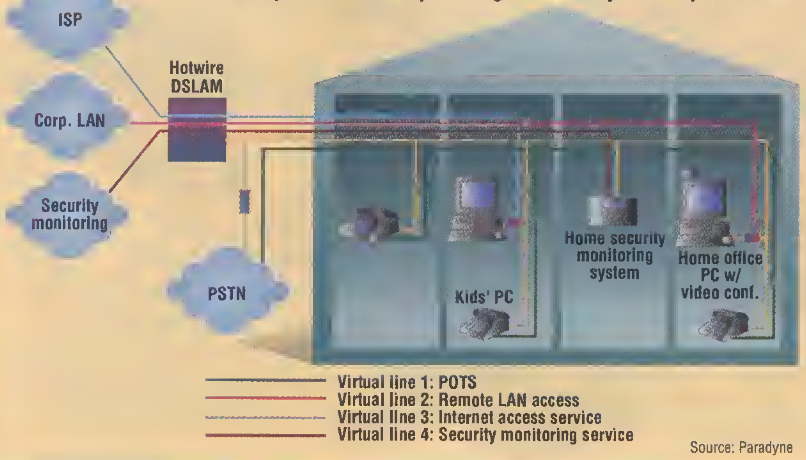
The capability extends out to 18 kft on 24 gauge wire from the central office. Speed falls off in nx64 increments at longer lengths.

"Only a small percentage of customers need 2.5 Mbps to 7 Mbps supported by ADSL or RADSL. The mass market only needs 500 kbps to 700 kbps," he explains.

MVL differs from symmetrical DSL (SDSL) in that one twisted copper pair into the home supports multiple modems. It also turns the home's inside wiring into a LAN, which supports eight drops for eight MVL-type products and 4 kHz baseband POTS (see figure).

"The in-house wire goes to every jack in the house. So does our service," says Wiener.

ONE NETWORK–MULTIPLE SERVICES
Multiple virtual lines providing connectivity to multiple services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Virtual line 1: POTS
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Virtual line 4: Security monitoring service

Source: Paradyne

Because telcos do not have to deploy a POTS splitter at the home, as they must when deploying xDSL on a single wire, they can eliminate what would otherwise be a costly truck roll.

The network piece of MVL is a four port card that fits into a digital subscriber loop access multiplexer (DSLAM) located at the CO. A 7-ft. cabinet can support up to 576 ports. In the third quarter, Paradyne will offer a 16 port card, which will make it possible for a 7-ft. cabinet to support 1,000 ports. Because the MVL cards do not use much power, they do not dissipate much heat, which means higher density deployments can be attained without heat becoming an overriding issue, Wiener explains.

MVL requires less than 10% of the signal processing power as traditional DSL modulation schemes such as discrete multitone (DMT) and carrierless amplitude and phase modulation (CAP), which require 3W to 6W per port. This means that MVL cards can run using standard off-the-shelf digital signal processors (DSPs).

"The initial MVL offering will require less than 1.5 W per port, by the third quarter it will be down to 250 MW per port," Wiener says. "MVL has such low power and heat dissipation that you can get 2000 ports in a 7-ft. cabinet without exceeding Bellcore's NEBS standard."

The cards' low power requirements will make them well suited for use in digital loop carriers (DLCs), which are designed with an assumption that each card has a 1W-per-slot allotment, he says.

Paradyne plans to offer cards that will plug into existing DLCs in the second or third quarter, but is not yet disclosing which DLC vendors it plans to work with to develop them.

Paradyne is still finalizing MVL pricing, but expects to meet a cost of $300 to $350 per line in mass quantities by the end of 1998.

"With ADSL, everyone has struggled to get to $500 per line," Wiener says. "We expect MVL to send shock waves through the industry in terms of cost, functionality and performance."

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ROBERT K. HELDMAN AND PETER K. HELDMAN

America's Missing Infrastructure:

The third shoe drops

All eyes are on the states.

IT'S BEEN 14 YEARS since the first shoe dropped—the 1984 Divestiture ruling that precipitated the separation of local and long distance services, breaking up the Bell monopoly. The second shoe dropped when the Telecommunications Act of 1996 transformed the local monopoly into an open, competitive arena. Now, a third shoe has dropped—in the unlikely state of South Dakota.

In this second of a four-part series of articles, we describe the role for industry leaders and government entities to thrive in the post-Act information marketplace. Part I appeared in our Jan. 1 issue.

The Telecom Act promised exciting, new, advanced communications services offered affordably to all U.S. consumers. But the Act has fallen short of its goal. Two years since the passing of this historic legislation, we ask:

- Where are the exciting advanced data, video and multimedia networks to meet current and future needs at home, at business, in schools and in hospitals?
- Was the law all that was needed to achieve meaningful change?
- What new communications capabilities do home and small-business users have that they did not have 15 years ago?
- Where are the revenues from the billions of dollars poured into research and development (R&D) each year, and where are the advanced products and services resulting from those investments?
- Why are the goals of the Act still not achieved?

DIVERGENCE

The industry faces alternative pathways:

- Grow the marketplace pie by deploying a new, advanced telecom infrastructure to support public data, video and multimedia networking at higher and higher speeds; or
- Seek a larger share of the existing pie, which consists of plain old telephone service (POTS) and special services for limited markets.

The industry's traditional choice—to preserve the past and gain a larger slice—will leave data, multimedia and video users' needs unmet and market opportunities unfulfilled. No amount of time can make this path meet the goals of the Act.

It has become clear that the main beneficiaries of the Act are the industry's attorneys. Incumbent local exchange carriers (ILECs) have implemented a two-part response to the Act, which ostensibly entails "foot dragging" on implementing the Act's provisions and pursuing mergers and acquisitions. Using a series of protracted legal actions to delay and/or avoid opening up their networks to competition at affordable prices, ILECs apparently want to outlast the politicians and competitive LECs (CLECs).

ILECs have launched a flurry of mergers and acquisitions, valued at more than $88 billion, within their traditional arenas (Bell Atlantic/Nynex: $23 billion; SBC/Pacific Telesis, $16.7 billion; etc.) and outside their traditional sectors (US West/Time Warner and US West/Continental Cable at about $20 billion together). These mergers, which typically result in large debt and loss of talent and resources, push the industry further from deploying the needed advanced infrastructure which would enable ILECs to take advantage of the explosive growth in the fully switched, fully available, public data, video and multimedia network services markets.

UNTAPPED OPPORTUNITY

The Telecom Act, coupled with dramatic technological advances over the last 20 years, have created an exciting arena with new rules, new players and untapped market opportunities. The existing network has been opened for resale. Advanced digital and optical technology renders bandwidth a commodity, and creates a world in which features and services are paramount. Although danger lurks for the ill-informed as charlatans tout impossible claims about their product or technology's capabilities, there are vast opportunities for savvy players.

For years, the traditional telecom sector has failed to meet market needs for services that are affordable, switched, feature-rich, and support public data, video and multimedia networking. With a long history as regulated monopolies with a limited vision and strategy for anything other than telephony services, they have demonstrated since divestiture that they are uninterested in the challenges and opportunities ahead. They have resisted the deployment of advanced technologies which could have affordably delivered fully switched, advanced services at the increasing bandwidth rates required by users.

The ILECs have chosen instead to protect the imbedded POTS network and artificially high pricing schemes. They maintain a premium pricing mechanism for bandwidth, roughly based on the number of voice calls a given circuit can carry rather than the actual cost of providing the service and the inherent value of the applications it supports. This policy ignores the ability of technology to deliver virtually infinite amounts of bandwidth at prices comparable to POTS.

However, ILECs days are numbered. Competitive market forces eventually will establish bandwidth as a commodity as they recognize that new features and services will deliver differentiating value and high-margin returns. This is a great opportunity for facilities-based CLECs.

To compete successfully, companies must provide differentiation based on service offerings, not simply price.

KEY TO SUCCESS

The three keys to success in the post-Act arena are *infrastructure, infrastructure, infrastructure.* A fully switched network infrastructure must be deployed to meet narrowband, wideband and broadband networking needs.

To compete successfully, companies must provide differentiation based on service offerings, not simply price. As the power of technology is applied to slash the price of bandwidth, reseller margins will be placed under intense pressure. In the long run, the facilities-based competitor that can control its own destiny has the advantage; it can use digital and optical technology to offer advanced network features and services at dramatically lower prices.

Without this new infrastructure, ILECs and resellers will be forced to carve up the existing telephony market pie, providing limited advances over the current voice infrastructure and forcing smaller and smaller margins as more players enter the field.

Telecom brownouts already are occurring throughout the United States as users, lacking a viable data networking alternative, use and abuse the voice network with everything from credit-card verifications (short holding times) to Web browsing activities (long holding times). The voice network was not designed to handle data traffic—it is the wrong tool for the job.

There is no need to burden the traditional voice network's higher layers with data and video traffic that can cause extensive blocking, overloading and backhauling. A new network infrastructure with a new class of switches provides an attractive alternative path for all carriers. Customer information can be transported to numerous competitive, alternative networks and new service providers (as the Act envisioned), and the traditional voice network can be protected from abuse and eventual destruction.

A NEW ROLE FOR LEADERS

The competitive environment and market needs for advanced services combine to establish new roles and opportunities for those willing to step up. New industry leaders must break out of the "connect and collect" mentality to build an advanced infrastructure that meets present and future needs. Those who cling to past monopolistic tenants of providing limited offerings and few features at high prices will be left in the dust.

New leaders will leverage the many advanced digital and optical technologies (now dormant on the shelves of the world's great supplier R&D labs) and will enjoy the resulting large slices of a new, richer, information market pie.

A NEW ROLE FOR STATES

For state governments, the Act has created a role with new responsibilities. Given the complexity and capital-intensive nature of deploying a new infrastructure, strategic leadership is essential to establish the correct direction. Without cohesive leadership, a patchquilt of incompatible, dissimilar network solutions with limited, selective areas of coverage will result—and it will prove far more complex than making a call across the 30-odd incompatible voice telephone company networks that served New York City at the beginning of the 20th century.

Proper incentives and protection must be provided to ensure that the playing field is free from unfair competition when deploying these new networks; however, an open and competitive environment must be maintained, as mandated by the Telecom Act.

There is no longer a regulated "keeper of the network" who manages the integrity and direction of the infrastructure and looks out for the consumers by ensuring that regions do not enter into the information age with information haves and have-nots. States must step up and fulfill this role. While state public utility commissions (PUCs) have historically provided regulatory guidance, they have not set comprehensive strategic policy.

(Indeed, these PUCs will be quite busy for the foreseeable future as they carry out issues related to the Telecom Act, such as arbitrating disputes and establishing wholesale pricing schemes for resellers, etc.)

THE THIRD SHOE HAS DROPPED

South Dakota knows well the hardship that a lack of public infrastructure can bring. It is among the few states without a major east-west or north-south railroad. Many of its small towns dried up when the interstate highway system bypassed them, and the state lost much of its commercial air service with the deregulation of the airline industry. As the information age progresses, South Dakotans must have an advanced communications infrastructure to compete and thrive in the new millennium—or the state will "dry up" as a whole.

History was made last year when South Dakota's governor and state legislature overwhelmingly voted into law a new telecommunications policy to ensure that all state residents enjoy the benefits of a well-defined, advanced telecom infrastructure.

The law (see box below) establishes direction and leadership. It focuses on the considerable resources that industry players spend each year on a common infrastructure solution. It provides specific direction and goals for the state by defining three new networks required to meet South Dakota's current and future communications needs:

- **A narrowband network,** which leverages existing copper voice telephone lines to achieve a 10-fold increase in capacity over the digital switched network, delivering up to 144 kbps capacity;
- **A wideband (transitional) network,** which stretches the copper lines to their limit and launches use of some fiber optic lines, and will range in capacity from 144 kbps to 45 Mbps, yielding a 1,000- to 3,000-fold increase in capacity; and
- **A broadband network,** delivering switched fiber optic networking to the desktop at speeds ranging from 150 Mbps to 622 Mbps to 4.8 Gbps to into the Terabit range, establishing a 100,000- to several million-fold increase in capacity over today's networks.

The law details technologies, standards, capabilities and minimum user interface requirements for the networks. Existing plant is to be leveraged and new plant established to form an open infrastructure, as envisioned by the Telecom Act. The new networks should implement phased-in deployment, which allows a cadre of new, nontraditional facilities-based service providers to join in. The law further directs the South Dakota PUC and other branches of state government to promote and establish these networks in all actions, decisions and policies.

Peter K. Heldman is president of the Telecommunications Planning Institute (TPI; Englewood, Colo.) and is the author of Competitive Telecommunications *(McGraw-Hill, 1997). Robert K. Heldman, a principal of TPI, formerly was chief scientist at Northwestern Bell, held numerous planning positions at ITT and GTE, and is the author of several books on the industry. The authors can be reached at 303/850-7636.*

Seeking a standardized network solution that meets user needs for security, survivability, addressability, robustness and affordability, the law defines the exact infrastructure. The stakes are great; indeed, this state cannot afford to pursue a limited or wrong solution.

The eyes of the nation will be on South Dakota and other states to see whether service providers are serious about providing a new infrastructure for data, video and multimedia services—or whether they will abandon America's future market opportunities. Who will manage, direct and incent the deployment of the new advanced infrastructure? It's up to the states and industry to provide the answer.

The genie cannot be put back into the bottle. ILEC efforts to foot-drag the inevitable inroads of competition will fail in the end. A better course of action is to acknowledge the untapped market opportunities for advanced networking services. Shareholders and consumers are better served as service providers use their resources constructively to compete in the market, rather than in the court room. South Dakota's leadership has embraced this new environment, and can be a model for other states, as well as ILECs, CLECs, equipment suppliers and end users, to follow. ■

SOUTH DAKOTA'S TELECOMMUNICATIONS POLICY ACT

"It is the intent of the legislature that South Dakota have a telecommunications infrastructure that meets the advanced communication needs of the state's individual citizens and its communities of interest, including our schools, medical facilities, businesses and all levels of government. To achieve this intent, three new networks, accessible by all South Dakotans, will be established: a narrowband network, a wideband network and a broadband network. Together, these three networks will form South Dakota's new advanced Public Communications Network Infrastructure.

"This infrastructure will enable any-to-any voice, data, video conferencing, graphics, image and multimedia communications.

"These three networks will fully support the following capabilities requirements: ubiquitous, feature-rich, standard, secure, private, survivable, robust, addressable, switched, symmetric, affordable and available.

"Communications services will be reasonably and affordably priced to promote the growth and usage of each of these three new networks, leveraging the power of technology to provide ever-increasing bandwidths at ever-diminishing cost of facilities.

"Classes of service will be created for network services in order to establish a new service-based and value-based pricing model.

"The new narrowband, wideband and broadband communications networks will be established in a manner ensuring that all the citizens of South Dakota realize the advantages of the forthcoming information age, including economic development, educational opportunities, a heightened level of medical care, and better, more efficient service from all levels of government."

—South Dakota Statute Chapter 49–31

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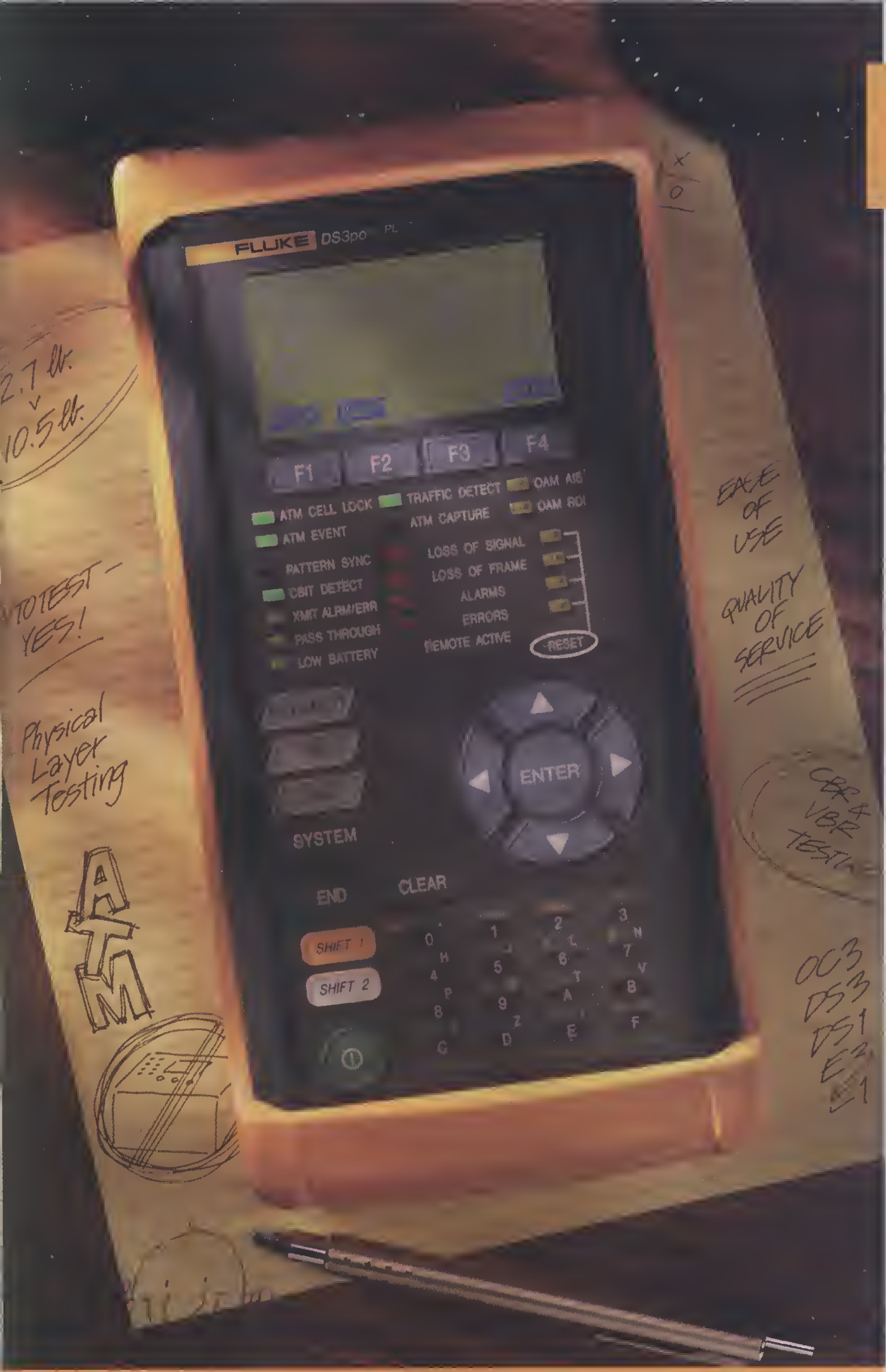

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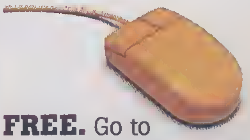

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Circle 104

ANNIE LINDSTROM

He's back ...

Royce Holland is out to show the CLEC industry how it's done.

Royce Holland is the name and telecommunications competition is his game. Holland's success as president and chief operating officer of MFS Communications Co. Inc. (Omaha, Neb.), a post he left after MFS was gobbled up last year by WorldCom (Jackson, Miss.) made it possible for him to be a man of leisure for life, but it didn't take him long to decide to get right back into the game.

Holland, and former Bear Stearns & Co. Inc. (New York) investment banker Tom Lord, in April co-founded a new competitive local exchange carrier (CLEC), allegiancetelecom inc. (Dallas). In 1992, Lord led Bear Stearns' underwriting of the nation's first initial public offering (IPO) of a competitive access provider (CAP), Intermedia Communications (Tampa, Fla.). He then led MFS' IPO with Salomon Brothers Inc. (now Salomon Smith Barney; New York) in 1993. It was a worthwhile effort—MFS shares, which initially sold at $20 per share, today are worth more than $125.

Holland and Lord held their first brainstorming session during last year's Association for Local Telecommunications Services (ALTS) conference in Orlando, Fla., while riding around Disney World's Magic Kingdom on the monorail.

"It was the only place we could get some privacy and actually start kicking around some ideas," Holland explains.

If past experience is any indication of future performance, the industry's eyes should be trained on Holland, chairman and CEO and Lord, executive vice president of corporate development, as they began to roll out service. Over the next three years, they plan to push allegiancetelecom into 24 metro-area markets, serving 50% of the country's business access lines.

The nation's investment bankers are betting on Holland and Lord. In August 1997, allegiancetelecom closed on what Lord says was the largest amount of equity capital ever raised for a wireline start-up in the United States — $100 million.

Holland recently discussed past endeavors and future strategy with *America's Network.*

From left, Tom Lord and Royce Holland of allegiancetelecom.

AN: Is the same thing that happened to MFS going to happen to allegiancetelecom?

Holland: You have a fiduciary duty to build shareholder value. When someone comes along with a big enough check, you do your duty with your shareholders. MFS got a fantastic offer from Bernie [Ebbers, CEO of WorldCom] for a 50% premium over what we were trading at. With allegiance, who knows? This industry is consolidating to some extent today, and I think that once the Bell companies get into long distance, that's going to accelerate. We are going to go out and execute our business plan and not worry about that.

So this is a good time to start a CLEC?

Holland: Now is a great time to get established. Two or three years from now, it might be tougher. Of course, three years from now there will probably be another opportunity that will look real good. There are some unique things you can do today like Internet access, Web server hosting, Web page design, high-speed data, ISDN [integrated services digital networking].

ISDN is a great example of something that is very underserved today. In my opinion, there is a huge pent-up demand for ISDN that is not being addressed to any extent by the Bell companies. To get an ISDN line in most markets today you'd have to wait a long time or pay a whole lot for it. I think, literally, ISDN will be our most popular product from the get-go.

So will you focus on applications such as telecommuting?

Holland: Not so much telecommuting, but distributed processing, for sure. We are going to have very broad coverage in each metro area. In the Dallas/Ft. Worth [DFW] metroplex, for example, we will be collocating our equipment in 35 Bell company central offices. We will address 75% to 80% of the business

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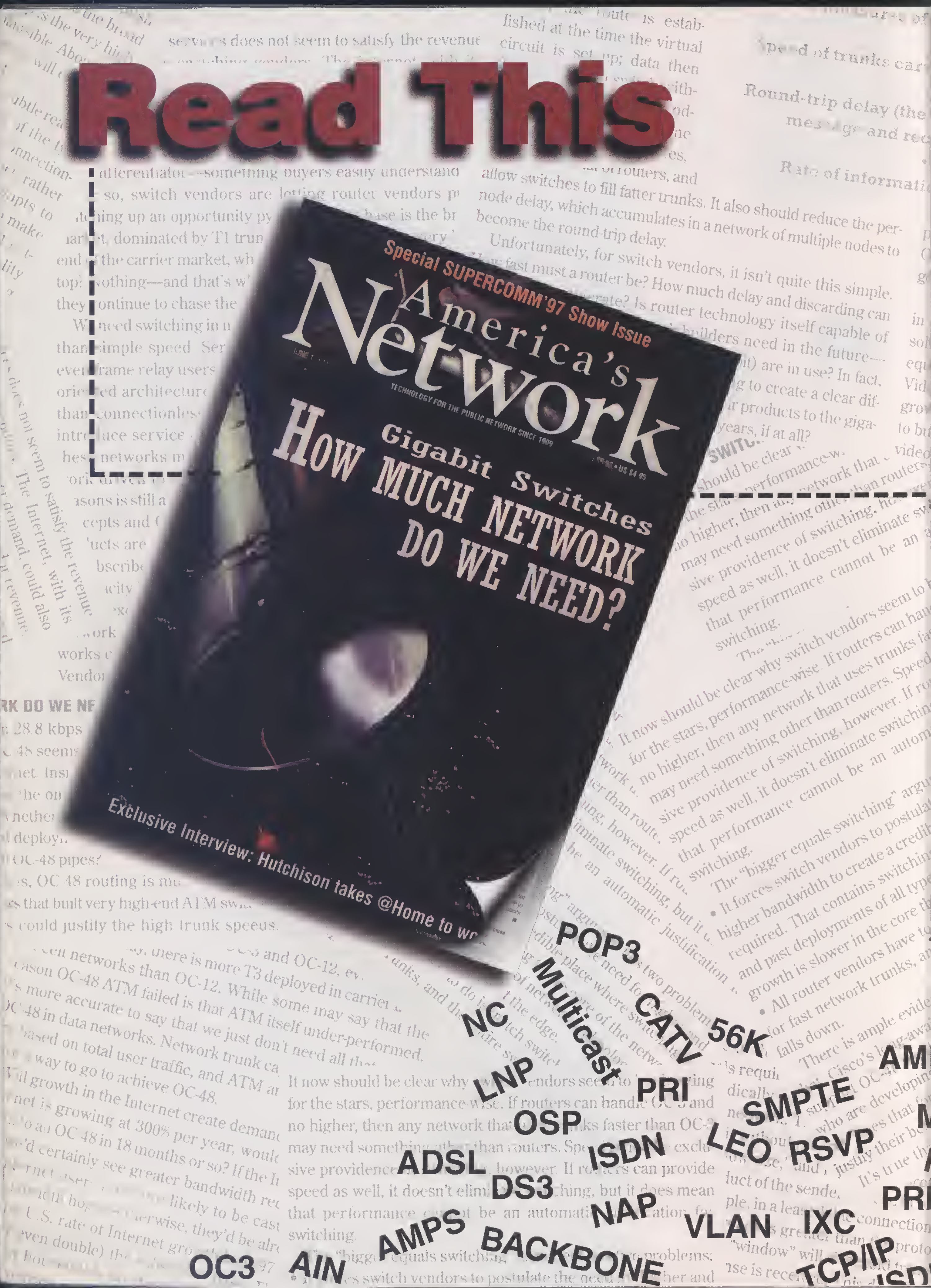

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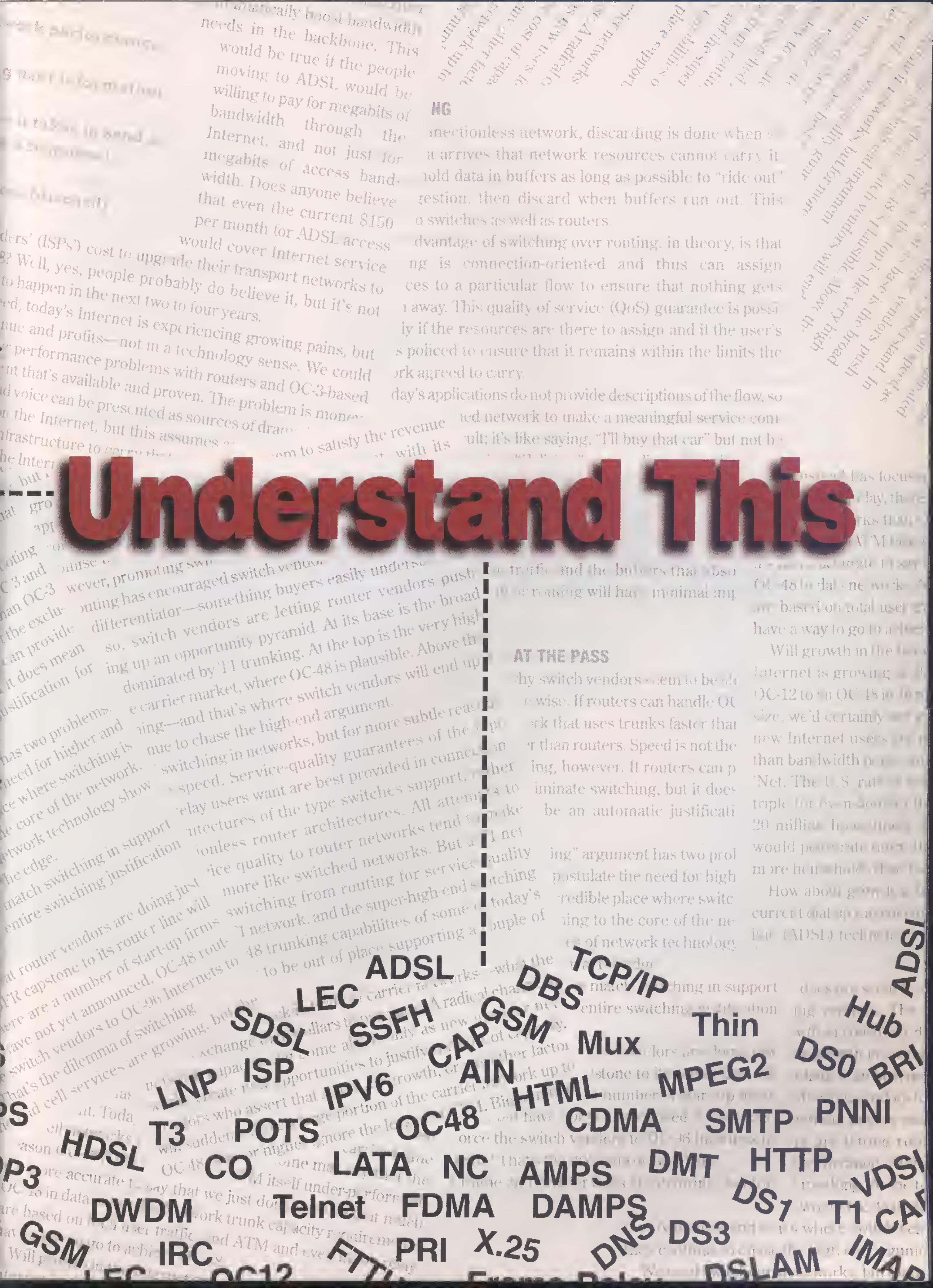

continued from page 29

access lines in the DFW metroplex and we will do the same thing in all of our other markets.

If a customer has 20 locations throughout a metro area, we will be able to give them a metro wide solution for everything—local, long distance, Internet, their data needs and all that. That's a huge competitive advantage. And what you need [to gain that advantage] are back office systems to give customers a geographically consolidated bill. Everything seems to come back to what I call the 'long pole in the tent'—the back office—it's our biggest challenge and the industry's biggest challenge.

What's your personal goal?

Holland: To start with a clean sheet of paper and really do it right. Not that we didn't do it right at MFS, but think of all the handicaps we had there. We had no interconnection, only a tiny piece of the market to address, yet we had to put all this money in the ground first. We spent two years getting city franchises and right-of-way agreements and everything else before we could sell anything, and even then, we couldn't sell much.

Now you can go into a market much more quickly .

Holland: We have Lucent 5ESS switches already in place in New York City, Atlanta and one to be delivered in Dallas. So we'll go in, put in a switch, collocate our transmission equipment in the COs and then we will lease capacity at very high bandwidth from the Bell companies. You couldn't do that prior to the Telecom Act. We are leveraging the Telecom Act.

So we'll lease trunk capacity from the Bells, or Worldcom or Teleport or WinStar—whoever gives us a good deal. Then we will use unbundled loops and DS1 tail circuits to get to our customers. As we gain a presence in a market, it will become an economic decision as to whether we should overbuild or not. We will do whatever makes the most economic sense. We don't have to go cut the streets. Here in New York, Metromedia wants to sell us a whole fiber network—they will provide us with dark fiber all over the city. This time, we will be in the market six months when we decide to go ahead, as opposed to 18 to 24 months under the build-it-first, sell-it-later type approach.

> **'I think, literally, ISDN will be our most popular product from the get-go.'**
>
> *—Royce Holland, allegiancetelecom*

What is the most important thing you learned at MFS?

Holland: The importance of the back office, and understanding the complexity and the scope of the OSSs and back-office systems to a local exchange or one-stop-shop business. We didn't put enough capital into them, we didn't put enough effort into it and we waited to long to do so—and it became a huge bottleneck to the selling process.

I look at the market today, and a company like WorldCom with MFS probably has the best systems out there, but they are still way behind where they need to be. There is no excuse for me not going and getting the people that really understand that.

Half of the people I have on board right now are dedicated to developing the best OSS. I'm mixing software people who think outside the telco box with experienced people who have been out there provisioning service for the last three years and have all the battle scars. We have a clean sheet of paper and no customers. Shame on us if we can't have the best systems in the industry come March and we'll improve them a lot after that.

So you are saying that these systems are the key to customer service, which is the key to overall success?

Holland: It has to do with everything … getting it ordered, to getting it provisioned, installed, billed collected and providing the utmost in customer service. If all those systems aren't automated then it won't work.

So how much money are you willing to put into your back office and OSSs?

Holland: I've heard of companies that have poured $200 million into systems like this and then have had to write it all off. It literally is a black hole. If you listen when a telecommunications company tries to develop all of its own software systems, you will hear a loud sucking noise with a lot of greenbacks going down the hole. We are going to the people who have done it before and make it their business to develop the best systems. We are not hiring software engineers and developers; we are integrating available systems and selecting best-of -breed products.

Who is going to do your billing system?

Holland: We are going to outsource our billing. If you can get the data in the right form, billing becomes more of a production function that is very easy to outsource. Billing is dependent on the front-end systems. You've heard the old saying: garbage in, garbage out … if you put garbage into the billing system you'll get garbage out. Part of the garbage comes from having different data put into the billing system than got put in with the order-entry system.

So how will you deal with that?

Holland: A lot of the provisioning will be done using a Bell company as a supplier, so we've got to feed into a Bell company interface. Right now, that is a manual interface—a fax or an e-mail that they will have to refeed. We are going to drive the Bell companies to interface with us with an electronic order-entry system. We are pushing that and we will continue to push it.

We are in a unique position because I don't care if the RBOCs get into the long distance business. We'll support the 271 filing of any RBOC that will work with us, to make it so that their provisioning system talks to ours and that can demonstrate for a month or two that it works, and we can actually provision service almost as easily as you can provision long distance today. AT&T, Sprint, MCI and WorldCom are never going to say that, so that's a difference we have—some more ammunition we have to bring to the table. ■

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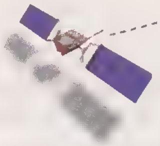

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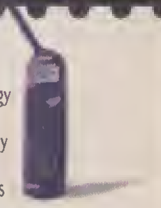

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3G wireless:

Will the best technology win?

You could call the duo Preston Tucker and Don Quixote—one an inventor ahead of his time, the other a knight who tilts at windmills. Only then would you capture the essence of Gary Lomp and Herschel Shosteck.

Both are mavericks in the third-generation wireless wars. Lomp says his company has developed a top-performing broadband air interface that solves virtually all of the propagation, noise and signal fade problems of IS-95 and will pave the way to a multimedia wireless world. Shosteck, an independent consultant and market watcher, predicts fiscal disaster for wireless vendors pursuing piecemeal third-generation (3G) strategies. Both men have stories to tell—often diametrically opposed—about what 3G wireless, sometimes known as "multimedia PCS," will do in the next millennium.

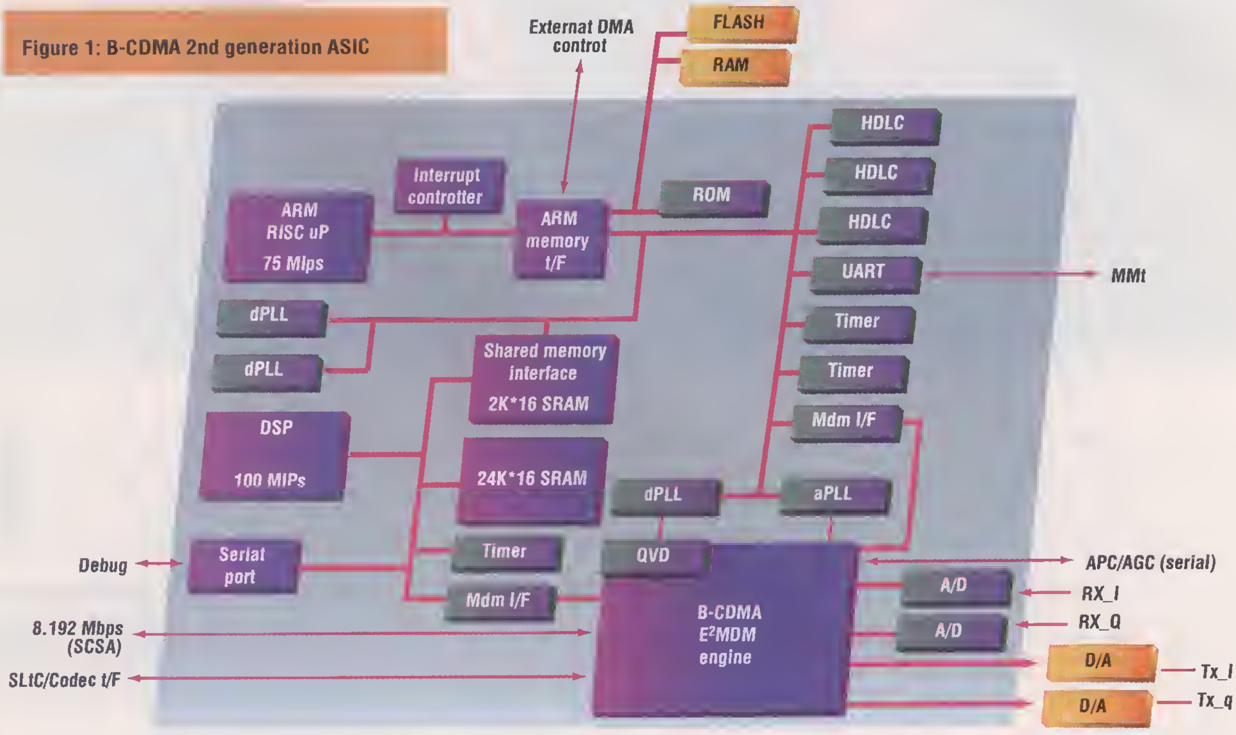
Lomp, senior vice president of technology development at InterDigital Corp. (King of Prussia, Pa.), is a key developer of Broadband Code Division Multiple Access (B-CDMA), a wideband (5 MHz to 15 MHz) CDMA radio air interface designed for toll-quality voice and advanced multimedia services. Ready to bow first as a wireless local loop (WLL) test product for New England Wireless in Vermont, the B-CDMA air interface will evolve into a mobile broadband product, Lomp says. It's one contender (albeit a dark horse) in the third-generation race to find the next standard for high-speed (384 kbps to 2 Mbps) wireless voice and data services, radio frequency (RF) allocations and infrastructure.

Shosteck (Herschel Shosteck Associates; Wheaton, Md.), a hard-driving analyst and predictor of future wireless markets, rattles the idealists. Together Lomp and Shosteck make compelling arguments about the future of advanced services and carrier revenue opportunities. They are swimming upstream in a political maelstrom—big-name vendors jockeying for 3G media attention; international standards groups considering multiple (and incompatible) 3G proposals; a Japanese NTT DoCoMo 3G wireless project grabbing headlines and creating a global R&D burden—all forcing the next-generation issue some five to 10 years before second-generation personal communications services (PCS) mature and wireless multimedia arrives in any place but Japan.

NEW AIR INTERFACES?

"The message today is that there isn't anything driving the development of an enhanced air interface other than indus-

Figure 1: B-CDMA 2nd generation ASIC



Source: InterDigital

try and global politics," Lomp observes. "But we already need a new air interface for existing wireless services; air interfaces today are overloaded, unreliable, and don't even offer the performance that's required for existing digital services [e.g., voice and data up to 384 kbps]. When you start talking 2 megabit data services, clearly you need an upgrade of the network."

Shosteck has a different view: "Right now you have a competition, a pissing contest between Japan Inc. [the Ministry of International Trade and Industry; MITI] and the Ministry of Posts and Telegraphs; MPT] and the European Telecommunications Standards Institute [ETSI] for the development of a 'universal' multimedia wireless standard," he says. "But will it be salable? Will there be a market? ETSI is looking at what the Japanese are doing in third-generation wireless and saying, 'We can't let them get ahead; they might do to us what we did to them with [GSM; Global System for Mobilization].' So, ETSI is charging ahead to introduce their third-generation proposals to assure the Europeans have a defensible position. With this, you have [worldwide] standards bodies leading the charge toward a technology which is not necessary and which cannot work."

Shosteck predicts serious problems for vendors and carriers entering the 3G fray. In their study, *The Future of Wireless Infrastructure and Terminals, 1998-2007: The Evolution to Third Generation*, Shosteck argues the industry is overemphasizing RF issues at the expense of thinking through the timing, research and development (R&D) costs, network infrastructure issues and market demand for wireless multimedia and bandwidth-on-demand.

FOR SHOSTECK'S RECORD

Shosteck says that the current brouhaha over 3G wireless is just that: "The driving forces for third-generation lie not in the need for new technology and the new services associated with them, but in the politics of Japan and Europe." That controversial explanation could be fuel for shock and outrage among wireless vendors and standards makers, yet many acknowledge that Shosteck has been right too many times on other cellular and PCS issues.

> **'If you go to third-generation, you're going to require greater network density to deliver high capacity and throughput, which fiscally cannot work.'**
>
> *—Herschel Shosteck.*

- Issue No. 1: The 3G efforts of Japan's NTT DoCoMo, the largest cellular carrier in Japan with 10 million subscribers, appears to be ramping up standards activities globally and driving vendors to form interim alliances, devoting substantial R&D dollars to wideband solutions in a yet-unknown market. For example, Lucent Technologies (Murray Hill, N.J.) and LM Ericsson (Stockholm), two among a group of wireless vendors competing for NTT's DoCoMo's wideband CDMA 3G network systems—a network scheduled to deliver wireless multimedia to commercial subscribers by the century's turn—have established specifically broadband research labs in Japan. Ericsson and Nokia (Finland) are developing their their own flavor of wideband CDMA (WCDMA), a GSM-based technology.

NTT DoCoMo and the Japanese standards organization ARIB (Association for Radio Information Broadcasters) now support WCDMA based on an evolution of the GSM core network infrastructure, an apparent victory for European GSM vendors like Nokia and Ericsson. Japan will watch Europe closely as the ETSI convenes to consider competing 3G proposals. "Japan wants to have not just a Japanese [third-generation] standard, but a global standard," observes Alistair Urie, a director of product strategies for Alcatel (Paris).

- Issue No. 2: As many as five competing proposals for the next-generation European wireless standard, Universal Mobile Telecommunications System (UMTS), are now before ETSI. Most likely, the International Telecommunication Union (ITU), the reigning wireless standards body, will need to consider an even greater number of competing 3G proposals when it convenes in June to establish IMT-2000, the global standard.

- Issue No. 3: Nokia and Ericsson, and Alcatel and Siemens (Munich) have aligned around separate and different wideband proposals for 3G systems. Nokia/Ericsson is pushing a version of 5 MHz WCDMA as the air interface; Alcatel/Siemens, with other vendors such as Bosch Telecom (Dallas), Motorola (Schaumburg, Ill.), ItalTel and Nortel (Research Triangle Park, N.C.,), is promulgating a hybrid air interface known as Time Division (TD)/CDMA, an interface that combines some aspects of Time Division Multiple Access (TDMA) and CDMA together and may be more easily backward-compatible with existing second-generation GSM core networks.

"Even in Europe, which has been fairly united in its beliefs, we see cracks developing between groups of European wireless vendors," observes Lucent Technologies' Robert Sellinger, director of PCS in Naperville, Ill. "The [ITU] may have to look at seven or eight significant proposals for [3G systems], all approaching the problems of 3G very differently."

- Issue No. 4: In the Americas, the CDMA Development Group (CDG; Costa Mesa, Calif.) and the Universal Wireless Consortium (UWC; the advocacy group for TDMA IS-136), also are ironing out 3G proposals that will be submitted to the Telecommunications Industry Association's (TIA; Arlington, Va.) Technical Committee TR 45.5 and, ultimately, the ITU. CDG is strongly behind a proposal known as wideband CDMA1, an extrapolation of existing IS-95 technology for higher speed data, says Perry LaForge, director of the

CDG. "There have been many proposals out there and a lot of hype," LaForge says. "The differences [in WCDMA proposals] are the kinds where we can get convergence … it makes no sense to go out and do something different technically for difference's sake."

THE POLITICS

Given all of this, why such a factionalization in the worldwide standards community? What is to be gained by politicizing an air interface, much less an entire vision for a global wireless network, when technologies, applications, and market demand remain unclear?

The answers are complex. Most wireless vendors need to defend drive current infrastructure investment while paving the way for the future. Eero Vallstrom, vice president of business development for Nokia, says that demand for wireless multimedia services will exist worldwide, if spectrum is available. Japan and Europe already have allocated 2 GHz spectrum for multimedia wireless; however, in the United States, the spectrum picture is less clear.

"For GSM systems, we think a wideband CDMA radio technology fits better for high-bit-rate services, especially because it will be optimized for multimedia services," Vallstrom says. "A GSM radio systems network will continue to service subscribers. But a third-generation network will be a parallel network [requiring mostly different base stations for wideband CDMA]. When you look at the switching network behind the base stations, these will be the same for GSM and wideband CDMA."

Vallstrom argues that "existing GSM networks will have more than 50% of the world subscriber base in 2000. Also, when we add wideband CDMA radio systems to existing GSM core networks and optimize for multimedia services, we'll have very strong support in Europe, Japan and Asia, and a good chance of becoming a global standard."

The more cynical view is that the Japanese, advanced in their thinking and in need of new network capacity, are calling most of the shots. "What's taking place at [the European standards level] in UMTS is being driven by NTT

Which 3G standard will it be?

The 3G wireless standards battle in Europe is expected to grind down to two proposals: Ericsson/Nokia's wideband code division multiple access (WCDMA) and Siemens/Alcatel time division (TD)/CDMA. "The two proposals grew out of the same research project," says Alistair Urie, director of product strategies for Alcatel. "Over the last six months, more and more people are choosing which side to support." A final decision is expected at the European Telecommunications Standardization Institute (ETSI) Q1 1998.

The Ericsson/Nokia wideband CDMA is considered a more revolutionary departure from current personal communications services (PCS) networks, and will employ a flavor of spread-spectrum technology most compatible with Japan's NTT DoCoMo multimedia ideas. By contrast, TD/CDMA, the proposal from Siemens and Alcatel, is unlike the Ericsson/Nokia proposal in that it utilizes elements of time division multiple access (TDMA) in addition to CDMA, and therefore represents a "hybrid" technology that is considered more evolutionary than the WCDMA path.

As Urie explains, "the Siemens TD/CDMA technology starts with eight timeslots of GSM, and thus widens the bandwidth eight times from the original GSM [global system for mobilization] bandwidth up to 1.6 MHz. So in effect, instead of one code, you're putting in eight codes, and you're using TDMA for the inside timeslots."

This enables a mobile to transmit voice in one slot, then receive in the other, and have lots of other slots to find base stations. CDMA technology is used within each time slot, "So you now use the CDMA to stack up users in each time slot, so you get the flexibility of preserving the timing of GSM," Urie says.

"The hard decision will be ETSI's," Urie continues. "They're trying to harmonize everybody." Any number of scenarios could happen, but Urie expects that the TIA [telecommunications industry association] will at minimum adopt two proposals, one an IS-95+ and the other an IS-136+ to accommodate existing U.S. PCS systems and bring them to a wider band capability.

"In the states there will also be a third standard which will be the TR45.5 trying to adopt the ETSI standards. If ETSI goes for wideband CDMA, then Europe and Japan will have the same standard, but I believe GSM North America operators will be in big trouble, because current GSM networks can't deploy wideband CDMA without dismantling their networks in the PCS band," Urie says. "If the reverse, TD-CDMA, is adopted, the U.S. operators will be able to do something right in the 800 MHz spectrum by removing some of the carriers and replacing parts of the spectrum; the problem will then be for Japan. Japan wants not just to have a Japanese standard, but a global one." Rather than be isolated, "they may decide to jump across to TD/CDMA," he says.

Not everyone agrees with that assessment. InterDigital, Nokia and Ericsson say a form of WCDMA will be adopted. Kathy Zatloukel, a wireless expert at Hughes Network Systems (Gaithersburg, Va.), which has proposed a high-speed data overlay network to pave the way to 3G systems, says that market turf is the real issue. "The Japanese have forced everybody's hand to try to react to their new digital network solutions for third-generation wideband," she says. "The big thing for Ericsson is that they can get their operators comfortable with the fact that they can grow the GSM network for CDMA, and that's what is behind their wideband CDMA proposal. TD/CDMA is actually more backward compatible with existing GSM networks."

Many U.S. carriers are so busy with working out kinks in existing PCS that they haven't had time to think through third-generation issues, Zatloukel claims. But Keith Paglusch, vice president of network engineering and operations at Sprint PCS, says it isn't too early to figure out the next generation.

"I think in the end, the people who will tell us if this is a viable option or not is our customers," Paglusch says. "They'll tell us what additional services we can we bring to our customers; and what additional capacity we need. We're trying to understand what all the options are and what all the benefits are—GSM vs. CDMA, digital vs. analog; it's a crystal ball."

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- 19 ○ I Independent Cable TV System
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- 21 ○ K Other Cable
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- 31 ○ 13 **Mgmt.** (VP, General Mgr., System Mgr., Mgr., Director)
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- 34 ○ 5 **Personnel & Administrative Services** (Director or Mgr. of Training, Safety, Security, Buildings & Land, Supplies & Distribution)
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- 41 ○ D **Cable/Video/Multimedia Equip./Services** (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
- 42 ○ E **Customer Premises, Broadband Subscriber Equip./Services** (PBXs, Station Equip., ACDs, Videoconferencing, Remote Controls, Converters)
- 43 ○ F **Outside Plant and Construction Equip./Services** (Pedestals, Vehicles, Towers, Tools, Enclosures)
- 44 ○ G **Data Communications/MIS/Network Mgmt. Support Equip./ Services** (including LANs, WANs, & Network Software)
- 45 ○ H **Power & Protection**
- 46 ○ I **Test & Measurement**
- 47 ○ J **Other** *(please specify)* ____________
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of existing PCS interfaces] GSM++, or TDMA++, or CDMA++ [with] expected improvements in current technology will be able to deliver much of what third generation promises [at much less cost].

"Why go to third generation at this time?" Shosteck asks. "If you go to third-generation, you're going to require greater network density to deliver high capacity and throughput, which fiscally cannot work. In order to gain multimedia wireless advantages, even if there

than making wholesale replacements. But from NTT's perspective, Japan has tremendous demand for wireless service in a spectrally constrained environment. They're trying to solve this problem, and they're looking to solve this in a contemporary way. It's a very large market and an attractive one to companies like ours who are looking to expand our [wireless] businesses.

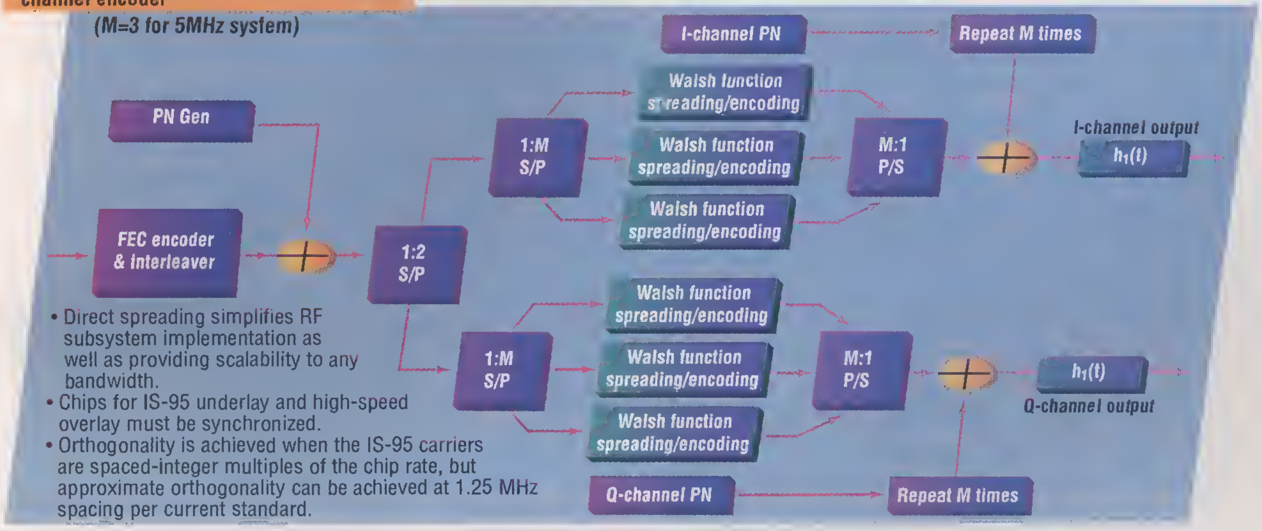
Lucent was required to deliver prototypes by the end of 1997, according to Sellinger. "These are early networks,

lating their networks and manufacturers from the rest of the world," notes Peter MacLaren, Nortel's assistant vice president of business development for wireless networks. "While they want to play a role in shaping third-generation design, their clear objective is to get a high degree of standardization.

"Throughout this process, there has been debate about how such a system could be globalized; and I have the perspective that it's DoCoMo's intent to use that work in order to influence what

Figure 2: Forward link high-speed channel encoder

(M=3 for 5MHz system)


I-channel PN
Repeat M times
PN Gen
Walsh function spreading/encoding
1:M S/P
Walsh function spreading/encoding
M:1 P/S
I-channel output
$h_1(t)$
Walsh function spreading/encoding
FEC encoder & interleaver
1:2 S/P
Walsh function spreading/encoding
1:M S/P
Walsh function spreading/encoding
M:1 P/S
$h_1(t)$
Q-channel output
Walsh function spreading/encoding
Q-channel PN
Repeat M times

- Direct spreading simplifies RF subsystem implementation as well as providing scalability to any bandwidth.
- Chips for IS-95 underlay and high-speed overlay must be synchronized.
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The more cynical view is that the Japanese, advanced in their thinking and in need of new network capacity, are calling most of the shots. "What's taking place at [the European standards level] in UMTS is being driven by NTT

DoCoMo," affirms Crispin Vicars, senior analyst for wireless at The Yankee Group (Boston). "Third-generation activities, in general, are being driven by NTT DoCoMo, and to a lesser degree what's taking place in UMTS."

Observes Shosteck: "The [ETSI] is throwing a bone at Ericsson and Nokia by accepting a GSM network architecture for 3G (also advocated by the Japanese), but developing a third-generation [air interface] standard that will give the Japanese manufacturers an advantage. Note that Japan's cellular carriers don't have alliances with Alcatel and Siemens. To my knowledge, Alcatel and Siemens have been left out. Siemens, being one of Ericsson's biggest competitors in terms of GSM, hopes to get their own 3G standard promulgated, and in that way cut out at least some of the European competitors.

"The irony," Shosteck continues, "and everybody has acknowledged this, is that by 2002, various [souped up forms of existing PCS interfaces] GSM++, or TDMA++, or CDMA++ [with] expected improvements in current technology will be able to deliver much of what third generation promises [at much less cost].

"Why go to third generation at this time?" Shosteck asks. "If you go to third-generation, you're going to require greater network density to deliver high capacity and throughput, which fiscally cannot work. In order to gain multimedia wireless advantages, even if there would be a market, which we doubt, carriers would be required to virtually double their investment in networks."

> 'By ... 2000, there will be $200 billion in second-generation infrastructure already in the ground.'
>
> *—Peter MacLaren*

POSITIVE OUTLOOK

Not everyone agrees that NTT DoCoMo's business case is bust. Lucent's Sellinger believes that Japan itself is an exhilarating market for multimedia services, and may be a bellwether for other parts of the world.

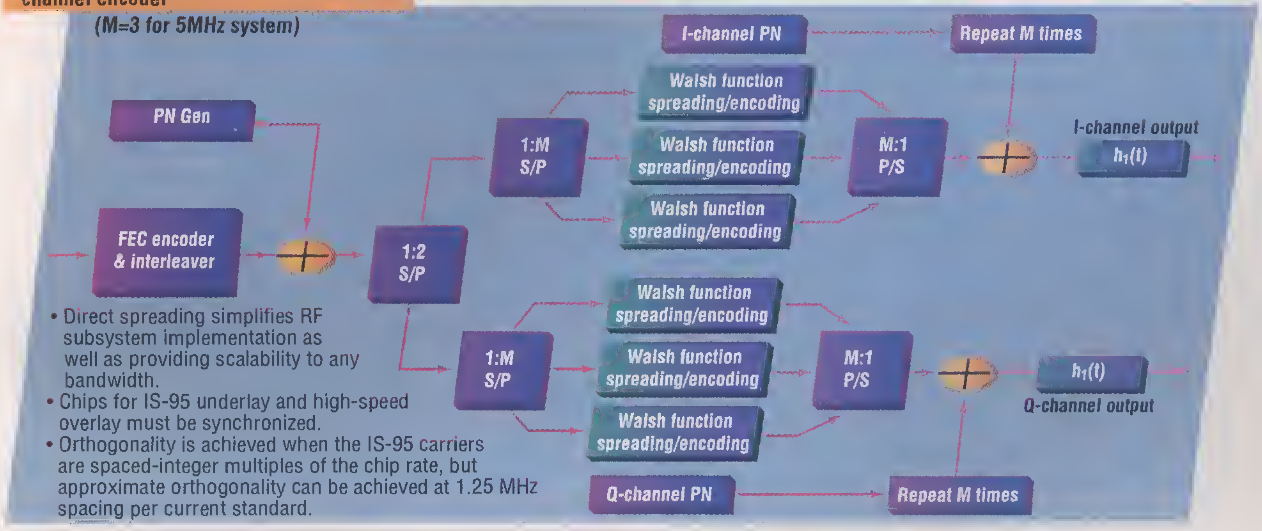
"It's anybody's guess whether carriers can make money from 3G," Sellinger says. "Any business case for this is a difficult one if it's not based on an evolutionary view [of existing network infrastructure], i.e., taking advantage of existing evolutionary networks rather than making wholesale replacements. But from NTT's perspective, Japan has tremendous demand for wireless service in a spectrally constrained environment. They're trying to solve this problem, and they're looking to solve this in a contemporary way. It's a very large market and an attractive one to companies like ours who are looking to expand our [wireless] businesses.

Lucent was required to deliver prototypes by the end of 1997, according to Sellinger. "These are early networks, and they've asked us for core pieces up to the API level (e.g., call processing)," he says. "The Japanese have done a tremendous job of stipulating in a detailed way the technical requirements for the prototypes; they're very complete in the totality of what's needed for commercial wireless service."

"The Japanese made it clear they recognize that in their first- and second-generation networks they ended up isolating their networks and manufacturers from the rest of the world," notes Peter MacLaren, Nortel's assistant vice president of business development for wireless networks. "While they want to play a role in shaping third-generation design, their clear objective is to get a high degree of standardization.

"Throughout this process, there has been debate about how such a system could be globalized; and I have the perspective that it's DoCoMo's intent to use that work in order to influence what

Figure 2: Forward link high-speed channel encoder


(M=3 for 5MHz system)
PN Gen
FEC encoder & interleaver
1:2 S/P
1:M S/P
1:M S/P
Walsh function spreading/encoding
Walsh function spreading/encoding
Walsh function spreading/encoding
Walsh function spreading/encoding
Walsh function spreading/encoding
Walsh function spreading/encoding
M:1 P/S
M:1 P/S
I-channel PN
Repeat M times
I-channel output
$h_1(t)$
$h_1(t)$
Q-channel output
Q-channel PN
Repeat M times

- Direct spreading simplifies RF subsystem implementation as well as providing scalability to any bandwidth.
- Chips for IS-95 underlay and high-speed overlay must be synchronized.
- Orthogonality is achieved when the IS-95 carriers are spaced-integer multiples of the chip rate, but approximate orthogonality can be achieved at 1.25 MHz spacing per current standard.

Source: Hughes Network Systems

happens at the ITU. The Japanese have already made the decision that the third-generation network infrastructure should be based in Japan on GSM network infrastructure. That wasn't their initial position."

U.S. carriers may have to invent in order to realize a next-generation network. Factions and consortiums will skirmish for competitive advantages; technologists will hammer out proposals; committees will meet and mavericks will poke holes in shaky ideas.

"By ... 2000, there will be $200 billion in second-generation infrastructure already in the ground," MacLaren says, "and the key thing that Shosteck brings up—namely, what is the transitional [case] to utilize those assets effectively —is a point well taken."

MacLaren agrees with Shosteck that the real difficulties in facing carriers will be network issues—developing seamless, intelligent network software and common platforms that leverage everyone's R&D dollars. "We need a real understanding of cost/benefits and technical approaches based on different alternatives that will determine the outcome," MacLaren says, "to lead to a solution the market will address, and a way to make it easier to design a technology converging to a single standard."

> **'There will likely be multiple standards for an air interface, given the existing infrastructures and the amounts invested.'**
>
> *—Gary Lomp*

Both MacLaren and Lomp doubt that convergence will happen anytime soon. "There will likely be multiple standards for an air interface," Lomp says, "given the existing infrastructures and the amounts invested. I don't think they'll be convergence with a third generation; we don't know as yet which digital standards from an RF point of view really work the best. For example, there are clear advantages to CDMA and TDMA. Everyone has his religion."

With intellectual property rights at stake, Lomp says the company has not proposed a 3G mobile standard to ETSI. "ETSI is not [considering] a wireless local loop third-generation standard, and that's what we've been doing," he explains. However, the company has discussed its ideas in proposals before the TIA/TR45 ad hoc subcommittee on WLL, and has briefed the ITU workshop on IMT-2000 Transmission Technologies in Toronto. In moving to a mobile flavor of B-CDMA over the next year, Lomp says, "we hope elements of our air interface will be adopted by technology partners."

NTT DoCoMo experimental system specs

Access method	WCDMA
Frequency band	2 GHz
Carrier bandwidth	5 MHz
Carrier frequency spacing	5 MHz
Number of carriers	two per sector
Number of sectors	six per BTS
Chip rate	4.096 Mcps
Frame length	10 ms
Time slots per frame	16
Services	
The following services are provided for:	
• Voice and UDI data	8 kbps–384 kbps
• Packet data	up to 384 kbps
Exchange terminals	
1.5, 2.0 and 6.3 Mbps	G.703/G.704/I.431
Protocols	AAL2 and AAL5
Maintenance tool interface	Ethernet, 10BaseT
Modulation, demodulation method	
Data	downlink: QPSK uplink: O-QPSK
Spread	downlink: BPSK uplink: O-QPSK
Demodulation	pilot symbol aided coherent detection RAKE
Coding	
Short code	256 to 16 chip layered orthogonal code
Long code downlink	10 ms 218 –1 chip Gold code cut into 10 ms length
Uplink	225 10 ms 241 –1 chip Cold code cut into 225 10 ms length
FEC coding	
Inner coding for traffic channels	convolutional (R=1/3, K=9) soft decision Viterbi decoding
Inner coding for control channels	convolutional (R=1/2, K=9) soft decision Viterbi decoding
Outer coding for UDI data	reed Solomon coding RS(36,32)
BTS diversity	RAKE + antenna
BTS synchronization	asynchronous

Lomp already has invested more than 10 years of his life developing the original military CDMA into a viable commercial technology. His lab is partnering with Siemens AG and Samsung (Korea) to develop B-CDMA under a breakneck schedule. "Our implementation is as strong or stronger than anything out there," Lomp claims. InterDigital has developed a second-generation B-CDMA ASIC that significantly reduces costs; Lomp also has demonstrated B-CDMA for wireless Web browsing and video conferencing at 144 kbps without even a screen flicker.

"The transmission is fundamentally more stable and easier to control than IS-95," Lomp says. "The vendor community is paying attention to it, but they're not endorsing it openly. That's tantamount to admitting that InterDigital has a technological edge, that we hold or own certain intellectual property that might be critical to 3G development.

"Ideally, we'd like to see a convergence of ideas," Lomp continues. "And we'd like to see our proven ideas appreciated and possibly incorporated in third-generation standards. We're for convergence, not exclusion. We've got technology available right now that answers most, if not all the requirements for the third-generation air interface, so why not? Through our partnerships efforts, I believe this will happen." ■

Arielle Emmett is a telecommunications writer based in Wallingford, Pa.

WIRELESS Notebook

CHARLES MASON

WIRELESS E-911 SLOWLY TAKING SHAPE

Despite a mandate from the **Federal Communications Commission** (FCC), the issue of automatic location identification for wireless has been slow to take off. However, carriers are under the gun to begin the first phase of the service.

While the FCC could conceivably permit schedules to slip, 1998 is expected to be the year when wireless providers begin to offer their users a life-saving service that has heretofore only been available to them at home on their landline phones.

Wireless enhanced 911 (E-911) service will ultimately allow emergency service providers to locate wireless users who dial 911 to within about 400 feet of their precise location.

"A very large number of wireless telecommunications users cite security as a major reason why they subscribe to cellular and personal communications services [PCS]," notes Laurence Swasey, senior analyst with **Allied Business Intelligence Inc.** (Oyster Bay, N.Y.) "This service will give them what many think they are already getting."

While the wireless industry is quick to publicize the many lives that have been saved by its services, there have been many instances in which callers were unable to give their location, imperiling themselves or others.

"Often people have no idea where they are when they are traveling down an interstate highway, for example, especially when they are in an unfamiliar area," says Ken Arneson, president and CEO of **Xypoint Communications Corp.** (Seattle, Wash.), one of several vendors selling location services to the wireless industry. "And they are surprised to find that the police or medics aren't able to automatically locate them."

To roll out the same automatic location finding that is available over landline networks today, the FCC has set up a schedule for the industry's implementation of auto locating services.

During the initial phase, carriers must provide a cell site's 10-digit automatic number identification and the mobile user's 10-digit calling party number when a call is made to a public safety answering point.

That would provide authorities with a very rough idea of the caller's general location, but it would also fall far short of what will eventually be needed for public safety, Swasey and Arneson note.

When requested by public agencies, carriers must begin furnishing that information within six months after the start date of April 1998.

The second phase would offer a much more precise ability to pinpoint a caller to within 410 feet. Phase two is scheduled to begin in 2001.

However, for the system to work, carriers, state governments and others must cooperate and make decisions together. Wireless carriers have not been rushing to commit to any one technology.

"I think that they have had a lot on their plates and this service is seen as something that they could put on the back burner for a time," Swasey says. "But push is coming to shove and these decisions are going to have to be made."

With the FCC rules in place, the onus is partially on state governments to enact a system that will lead to wireless E-911 availability within their borders. According to a recent survey conducted by Xypoint, 21 states will consider E-911 cost-recovery bills during the upcoming months.

The FCC requires states to have a system in place whereby carriers are compensated for costs incurred. Only 10 states have done so, so far. Swasey says this slowness has impeded progress.

States that have enacted cost recovery systems include Colorado, Minnesota, Oregon, Texas and Washington. The Xypoint study says that 14 states failed to enact E-911 bills in 1997.

METAWAVE INKS FIRST DEAL

While the commercial market for advanced smart antenna technology remains in its infancy, **Metawave Communications Corp.** (Redmond, Wash.) has won its first contract. The contract takes the company's technology out of the field-trial stage into full-scale use.

Metawave has signed an agreement with **Telefonion Celular del Paraguay** (Telecel) to equip that company's network with the smart antenna technology.

Under terms of the contract, the financial details of which have not been disclosed, the subsidiary of **Millicom International Cellular S.A.** will install its SpotLight Mutibeam Antenna platform beginning in the first quarter of this year.

Deployment will initially be in Ciudad del Este in eastern Paraguay, according to Mario Zanaotti-Cavazzoni, managing director of Telecel del Paraguay.

The company plans to use the SpotLight Multibeam antenna platform to increase the traffic-carrying capabilities of the network infrastructure.

"We want to avoid having to invest in these additional cell sites," Zanaotti-Cavazzoni says.

The ability to "fine tune" radio frequency (RF) patterns and to avoid building new cell sites is one of the prime selling points for smart antenna technology.

However, the business is, at least so far, taking off more slowly than some in the business had hoped.

Instead, many carriers remain focused on other issues or want to see the technology prove itself before committing to capital investments.

"We're certainly working hard to get their attention," says Tom Crawford, director of product marketing at Metawave.

According to Crawford, the SpotLight Multibeam Antenna Platform is designed to work with existing cell site equipment to increase capacity, coverage and call quality.

"We believe that as this technology shows what it can do and the competitive wireless market continues to heat up, smart antennas will become common parts of the network," Crawford adds.

DAVID KOPF

Multimedia middlemen

Developers begin to answer the question of wireless 'Net access.

For a few years now, wireless Internet access has been touted as the killer application for analog wireless carriers, PCS providers and Internet service providers (ISPs) alike. Heady dreams of countless road warriors whipping out their personal digital assistants (PDAs) to access online stock trading, sports scores or e-mail have tempted many a marketer into hyping such ideas before their time.

But dreams do not make solid business cases for network services. Technology does, and for a while, the technical details of wireless Internet access have been plagued with many difficult questions. Apart from the actual networks, the whole issue of making Internet content available and useful to a whole host of handheld and personal end-user devices is not easy to approach. How can service providers and technology vendors cram Web pages designed for 15-inch monitors onto screens the size of Post-it notes? How can devices devoid of any pointing devices interface with common Web page elements such as image maps?

Also, where do the solutions reside in the network? Should service and content providers offer custom pages for wireless users via technologies such as Handheld Device Markup Language (HDML)? Should proxy servers between users and Web sites tweak regular Hypertext Markup Language (HTML) content so that it works on the handheld devices requesting it? Does the intelligence to re-work Internet content sit on the devices themselves?

So far, these have not been easy questions to answer, but technology developers are approaching the question of wireless 'Net access from a variety of angles, and so far, the results may shed some light on how such services will take shape in the next few years.

REFRACTING, RESHAPING

About a year-and-a-half ago, Spyglass Inc. (Naperville, Ill.), known for its Mosaic World Wide Web browser, which it has licensed to the likes of Microsoft Corp. (Redmond, Wash.), began transitioning away from desktop PC browser technology and began focusing on reducing the size and scale of client technologies, says Dan Johnson, product marketing manager for Spyglass.

"Beyond that point, we really started to focus on non-PC devices that could incorporate thing-client technology," he says. "Now, we're dedicating all the company's efforts to that space, and are leaving behind the desktop computing world we started in."

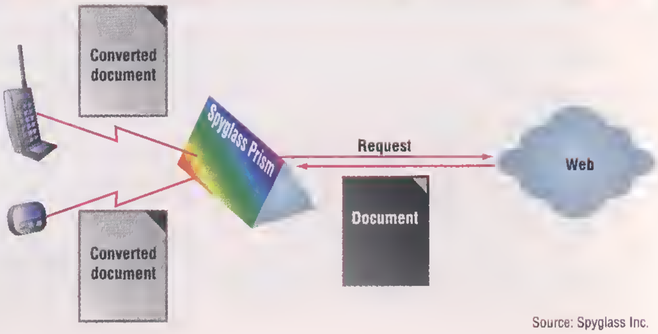
Spyglass soon learned that Internet access for handheld devices went well beyond embedding into small devices the basic ability to connect to the 'Net and draw down content.

"What we realized when we hooked those devices up to the 'Net was that they all had some kind of shortcoming," Johnson recalls. "It might be that they have small screen sizes like on screen phones, or slow connection speeds, small processors so that they can't do a lot of number crunching—whatever it was, they all had drawbacks."

The end result of that work—for Spyglass at least—was that some sort of supporting service technology was needed to rework Internet content to make it useful and effective on different devices. To that end, Spyglass developed its Prism server software, which takes existing Web content, which has been designed for PC-based viewers, and adapts it to the devices requesting that content, Johnson says. "This might mean changing color graphics to grayscale or reformatting text to fit on a small screen," he says.

Prism functions much like a proxy server (Figure 1), residing between users and the Internet content they want, collecting it and tweaking it. The Prism server contains a database of device characteristics that let it identify the limitations and abilities of specific devices requesting Web content. It then retrieves Web documents, and based on the devices' capabilities, adapts the content for those devices, Johnson says.

Figure 1: Where Prism resides in the wireless Internet access chain



Source: Spyglass Inc.

Prism can even take bandwidth into account. For instance, if a Prism proxy server knows that devices of a certain profile use low-speed access technologies, it can then eliminate graphics over a certain size before passing the content back to the devices.

> 'What we realized when we hooked [small] devices up to the 'Net was that they all had some kind of shortcoming,'
>
> *—Dan Johnson, Spyglass*

Prism accomplishes this via various components (Figure 2) that work together to reshape Web content. The system incorporates a Hypertext Transfer Protocol (HTTP) engine that interfaces with user device browsers that support HTTP. The HTTP engine passes requests it receives from those browsers on to a transaction manager that indexes those requests against its database of user and device profiles. The transaction manager then passes on the request, now appended with the profile information, to a content converter, which either converts documents it has already cached to fit the device, or downloads those documents via Prism's Web browser component and then converts them. Once the conversion is made, the content converter sends the tweaked documents back down the chain and to users' devices.

Various vendors and service providers have shown interest in Prism, including GTE (Irving, Texas), which licensed Prism last fall to use in a marketing trial in conjunction with M-Power Corp.'s (New York) enhanced-display phones; and Sharp Electronics Corp. (Mahwah, N.J.) and Nokia Telecommunications (Finland), which have both demonstrated their handheld devices working with Prism.

ACCESS AMALGAM

So does the solution rest solely upon the shoulders of proxy servers, or will device technology need to pitch in as well? What about the Web servers themselves?

An amalgam of all three solutions is the most likely answer, says Carter Hachman, marketing manager of Wireless Web Access for Geoworks (Alameda, Calif.), which entered into a technology partnership with Spyglass and licensed Prism last year. Wireless Web Access is Geoworks' reformatting server, and functions in much the same way as Prism, reshaping content for various wireless device profiles.

However, besides developing content-end solutions for service providers, Geoworks also develops operating systems (OSs) for mobile communications devices, which it then licenses to original equipment manufacturers (OEMs). Its two OSs are Geos 3.0 and Geos-SC. Geos 3.0 is a small, graphical OS that is scalable to fit the requirements of devices such as the Nokia 9000 and PDAs offering features such as voice, paging, e-mail, fax and Internet access. Geos-SC is smaller and geared less for PDAs and more for devices such as smart phones and other wireless devices.

Because Geoworks straddles both sides of the wireless Internet access spectrum (content and device) the company sees both sides of the dilemma, Hachman says.

"Content providers don't want to produce multiple types of content for different devices," she says. "And wireless devices that have browsers on them, each browser is capable of interpreting HTML to a different level. Rather than putting the onus of filtering that content onto that device, we are using a server to identify what browser is trying to receive the HTML and then provide all the filtering on the backend."

However, when an OEM licenses a browser, the browser will most likely still need to be re-engineered in terms of interface, Hachman says. For instance, say the device does not incorporate some kind of pointer, such as a mouse or stylus, software support for alternate input hardware must be built into the device's browser. For instance, the Nokia 9000 uses softbuttons to select options that users would otherwise interface with through a mouse.

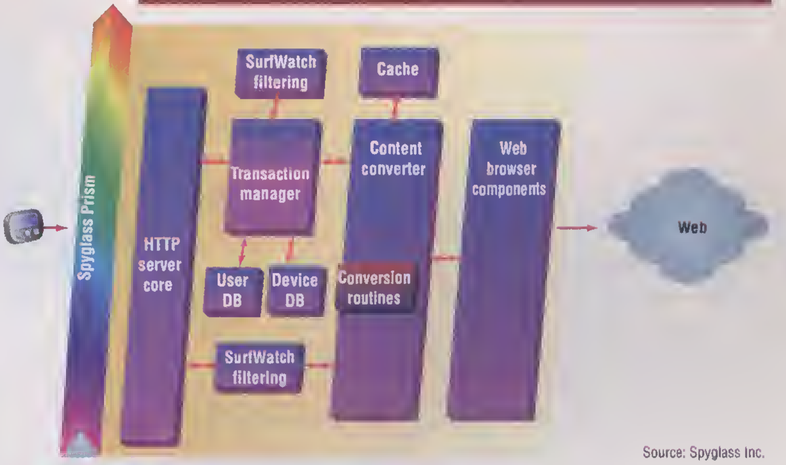
Also, not all handheld devices are created equally. Will certain designs become more popular? Hachman says that in working with carriers, Geoworks has found that the number-one requirement is that the device must be easy to use.

"If that means using a GUI [graphical user interface] or a menu-based solution—something that people can easily, easily use," she says. "When you look at the 'standard' digital phone now, getting data services is really hard."

On the content side, the idea of designing Web content specifically for handheld devices seems at best impractical. This is the reason for the emergence of Prism and Wireless Web Access. However, there may be a point where the distasteful idea of customized content may re-emerge, or at least someday content providers might start reconsidering their wireless viewers.

"I think that as wireless devices with browsers on them become more prevalent, we'll see a trend in the type of information accessed," Hachman says. "The providers of those types of content may start working more closely with this market." ■

Figure 2: Prism's World Wide Web content-conversion components



Source: Spyglass Inc.

INTERNET Notebook

Debbie L. Sklar

Yahoo!, MCI unveil joint Internet service offering

Yahoo! Inc. (Santa Clara, Calif.) and **MCI Telecommunications Corp.** (Washington) have entered a broad co-marketing and distribution agreement to launch a co-branded online service.

Yahoo! Online, powered by **MCI Internet**, is designed to provide consumers with an integrated Internet access solution with nationwide dial-up coverage. This online service provides users access to Yahoo!'s content and merchant services over MCI's network backbone.

The move is times with the Internet's ever-increasing consumer appeal. The population of worldwide Internet users is expected to surge from a reported 50 million last year to 100 million users in 1998, according to a study released in December by **International Data Corp.**

Yahoo! Online will provide subscribers with integrated access software, including a browser customized to feature Yahoo! aggregated content, 24-hours-a-day, 7-days-a-week. Subscribers will also have access to free member communication and community services, such as e-mail, chat, message boards and classified.

The service will also offer toll-free customer service and online and CD-ROM distribution of the client software. The dial-up points of presence (POPs) in major metropolitan areas along with X2-based 56 kbps modem access. The MCI network will help ensure reliable connections and fast response times.

"Yahoo! ... has a loyal base of more than 26 million unique users each month in the U.S.," says Jeff Mallett, chief operating officer of Yahoo! "Through our partnerships with MCI, Yahoo! Online will provide a complete solution for new Internet users as well as Yahoo!'s current customers, who have been accessing our services from work, school, and public access points and would like personal access from home."

Yahoo! Online will be promoted by both companies and is expected to be available nationwide later this quarter.

Population of U.S., European e-commerce businesses surges

U.S.-based providers of business-to-business electronic commerce (e-commerce) services should have a lot to look forward to. **Datamonitor** (New York) reports that there are almost 600 companies in Europe and 1,500 companies in the United states using the Internet for electronic-commerce (e-commerce).

The report, *Business-to-Business Electronic Commerce Opportunities in the Extranet Age,* has reveled that 64,000 European companies will be conducting Internet business commerce by the year 2000. The report also says e-commerce solutions are becoming Increasingly popular for small to medium-sized companies.

Value added network (VAN)-based solutions are the system of choice for large mission-critical business applications. However, by year-end 2000, Datamonitor predicts 64,000 companies in Europe and 173,000 companies in the United States will migrate to conduct Internet-based, fully integrated business-to-business e-commerce.

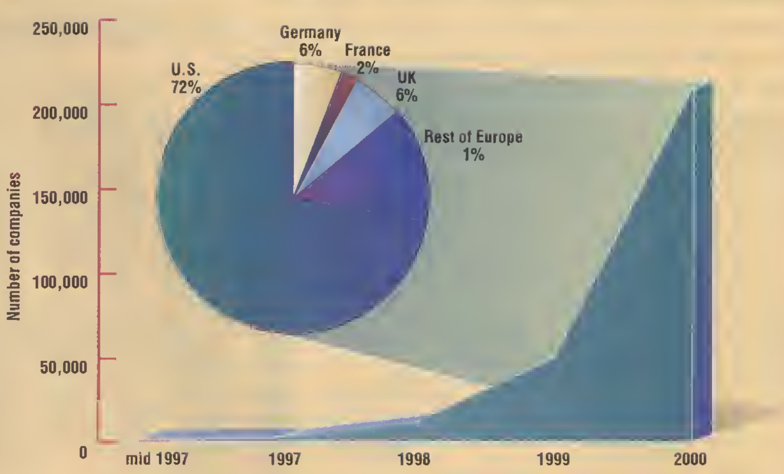
Datamonitor estimates the U.S. business-to-business e-commerce market is about 50% larger than the total European market, reflecting the much higher overall average technological sophistication of the businesses in this country.

In Europe, Germany has the largest number of companies conducting business-to-business e-commerce. France is slightly lagging behind the United Kingdom and Germany in its implementation of business-to-business e-commerce, which is due to lower penetration of e-commerce solutions among medium-sized French companies.

The remaining countries in Europe fall into two groups: highly developed, new technology-embracing nations, such as the Scandinavian countries and Ireland; and those that are less so. E-commerce in Portugal, Greece and the whole of eastern Europe occurs only in small pockets of industrial activity. Spain and Italy are threshold countries, that can have high quality advanced business-to-business e-commerce systems covering wider areas.

The study reports that, on the whole, VAN-and private network-based e-commerce solutions are the domain of large manufacturing companies, whereas Internet technology-based solutions, such as Internet-based virtual private networks (VPNs) are increasingly popular among small to medium-sized enterprises, as well as to lower-tier supplies in the supply chain. Datamonitor says an increase in VPN usage is likely to push e-commerce even further.

U.S. and European Internet technology-based electronic commerce companies, 1997-2000.



Source: Datamonitor

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FROM THE AMERICA'S NETWORK ARCHIVES

Sorry to disappoint, but those syrupy commercials touting how wonderful it is to connect with a loved one via the telephone are not the brainstorms of modern ad executives. According to an article in the November 1909 issue of *Telephone Engineer,* those "reach out and touch somebody" feelings were running strong 89 years ago.

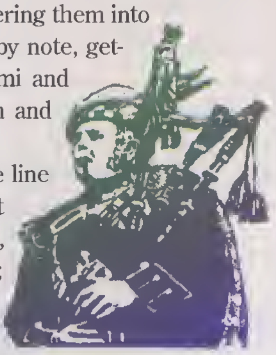
During the same time when screen siren Theda Bara was making silent movies, *The St. Paul Press* reported something new had taken place in long distance telephoning. Sure, business deals and marriage ceremonies had been performed via the telephone; a funeral service too; but the classiest stunt of them all was performed between the Twin Cities: a music lesson on bagpipes.

The feat was performed by Capt. George Sinclair of Minneapolis, formerly in the service of Queen Victoria as a piper in the Scotch guards, and William Wallace Robert Bruce, a well-known piper of St. Paul. As Sinclair sat in his chair in the Mill City Police headquarters, Bruce, at his home, puzzled over a new hornpipe composition by William Akey of Ayrshire, Scotland.

Sinclair told Bruce it was a difficult piece and his fingers needed to be limber. There were crochet (not the needlework kind), grace notes, several varieties of hemi, demi and semi-quiver, and also six distinct brands of quavers in the composition.

Placing his lips to the telephone transmitter and puckering them into a whistle, Sinclair went through the knotty piece, note by note, getting in each and every grace note, crochet, hemi, demi and semi-quiver, and all the quavers. He stopped for breath and then repeated the air.

There was silence. Then, from the St. Paul end of the line came the tunes of a bagpipe playing the hornpipe just right. Next came a cheery voice saying, "Hoot, awa, mon," which in Gaelic translates, "Well done, George; Scotland forever." The first music lesson on record over the telephone was over.



A WARM CHRISTMAS STORY

Love was swirling in the air and hearts of Lake Anne Elementary School students (Reston, Va.) and employees of Sprint's Government Systems Division (GSD; Herndon, Va.). The groups packed 4,000 pounds of warm coats, boots, hats and other winter necessities for a Christmas airlift to youngsters at the Orphanage for Children Without Parents' Care in Bosnia. Sprint GSD employees in Bosnia distributed the items to the children.

The orphanage provides care for 180 orphaned and abandoned children, and is working to offer daycare and schooling for hundreds of other children in the Tuzla area.

The Christmas airlift was organized by Sprint, which is installing a commercial communications system for the U.S. military in Hungary, Bosnia and Croatia. Sprint GSD employees in Herndon enlisted the help of the youngsters at the elementary school—which is the company's partner school under a Fairfax County business and education program.

Eva Hillard, Sprint GSD Dept. of Defense DOD Prog. Office and Ginger Farrell, Sprint Transportation Group, pack up donated clothing for a Bosnian orphanage.

A FLURRY OF MYSTERY BILLS

Think about how much you hate getting bills in the mail. Now multiply that 100-fold and you may begin to imagine how an Illinois veterinarian felt.

According to the *Associated Press,* Richard Baird spent November and December trying to dig his way out of an avalanche of telephone bills—sometimes hundreds per day—sent his way via a computer glitch.

The first few heaps of mystery bills started in November. They were for telephone numbers in the 614 , 814, 219 and 618 area codes—basically anywhere except his own phone number.

The bills kept coming in, listing call after call Baird had not made from number after number that was not his. To top it off, he also received numerous marketing pleas from AT&T. The vet and his staff spent hours combing through AT&T mailings for their real mail bill. (Not that there weren't a few benefits: AT&T sent out free Christmas CDs in letters promoting personal toll-free lines; Baird got at least 200, and gave them away as gifts.)

AT&T blamed a glitch in computer information supplied by Baird's local carrier. The torrent of bills later turned into a trickle when the company said it fixed the problem.

A little bitter at first about all the bills, Baird now can laugh about it. "My rural mail carrier, he's ecstatic. He gets rated on the amount of pieces he delivers," Baird says. "The guys at the post office said the whole blitz came during the week he was being rated."

DEBBIE L. SKLAR

An alternative to adding cable

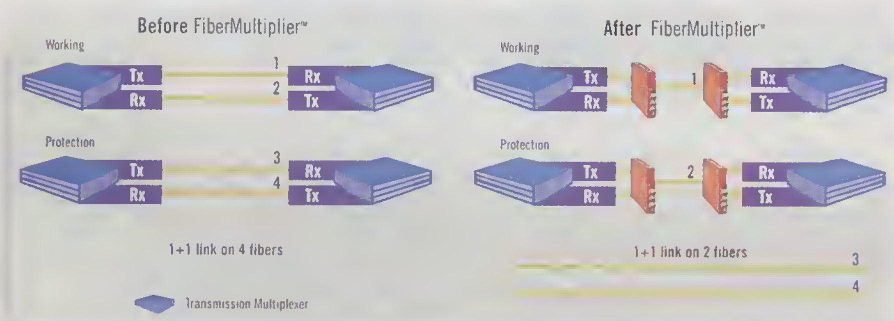
ILEC and CLEC planners are constantly faced with the challenge of having insufficient fiber to meet service demands. Adding new cable is slow and can be expensive.

The FiberMultiplier line of products—which include SmartCouplers and WaveShifters—concentrate existing links onto fewer fibers, freeing up fibers to use in new links. Moreover, new links can use less fibers.

SmartCouplers place the two directions of transmissions (at the same wavelength) safely onto one fiber. The units are placed at each end of a fiber link and connected by a single common fiber. The transmitter and receiver at each end are connected to these units.

Once installed into a network, the unit:

- Automatically verifies that the optical parameters of the fiber path will let the transmission link operate error-free;
- Enables normal operation of protection switching in the event of a Tx failure or path interruption; and
- Provides fault localization and fault type identification for Tx, connector or path faults.



An ~8dB transmission link power budget must be available; link lengths maximums are typically ~30 km. While connectors in the common part of the fiber path must be PC type, Txs and Rxs on the transmission equipment may have any type of connector. If pitchpanel connectors are biconic, SmartCouplers must be placed downstream.

The WaveShifter 300 uses active WDM to place two or more channels onto a single fiber. An active unit, which converts the 1310/1550nm WDM, is placed at one end of a transmission link, while a passive WDM component is placed at the other end. The two units are connected by a common fiber, and the Tx and Rx at each end are connected to the units. Multimode and multimode/singlemode units for ATM, Ethernet and fiber distributed data interface (FDDI) links are available.

For the WaveShifter to operate properly:

- Rx transmission equipment must operate at 1550nm and 1310nm;
- The fiber window at 1550nm must be available with an attenuation at least equivalent to that at 1310nm; and
- Either -48V power must be provided, or 110 VAC using an adapter.

The WDM function uses ~2.5 dB of transmission link power budget. The unit's boosters can be used to increase link loss budget.

Fitel-PMX (Ontario, Canada)

Visit www.fpmx.com or Circle 201

Wireline Product Solutions

Butting into POTS

The P-Phone Adapter allows use of a standard analog (POTS) test set on 8 kHz digital Centrex circuits, sometimes called P-Phone, MBS or EBS lines. Testing these circuits formerly required technicians to use specialized, costly digital test sets.

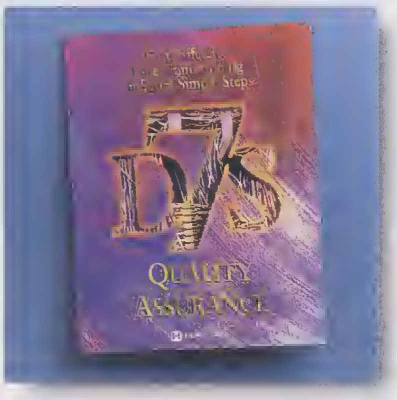
Priced under $175, the adapter may be installed on any existing "butt-in" test set of known quality. The adapter then may be left on the test set permanently. A simple POTS/P-Phone switch allows the test set to be used on analog or digital Centrex circuits. Loop limit on 8 KHz lines is 1230 ohms. The adapter is line-powered; no batteries are required.

Chesilvale Electronics Inc. (Bothell, Wash.)

Call 425/482-0121 or Circle 202

Line conditioning

The *DS7: Fast, effective line conditioning in seven simple steps,* brochure details benefits and features of DS7 quality assurance. Featuring the DATU-RT loop conditioning system and the SASS transmission conditioning unit, DS7 is an approach to maintenance and conditioning. The brochure provides information on how to characterize the configuration and physical condition of a line from any point on the loop, and to identify corrective action for maximum conformance with current transmission standards.



Harris Corp. (Camarillo, Calif.)

Visit www.nss.harris.com or Circle 205

Remote access modules

Implementing remote access from a centralized router with added LAN interfaces requires devices to be configured manually, offers a fraction of the total bandwidth capacity at any given time, does not scale well for growing networks, cannot keep running when a functional failure occurs, and does not offer comprehensive manageability.

Using the 9W006 and 9W007 remote access modules with the MMAC-Plus multimedia switching platform provides a simple, reliable, cost-effective central site solution to support dial-in connectivity for corporate telecommuters, remote offices and mobile intranet users.

The modules provide layer 2 and multiprotocol layer 3 switching as well as bandwidth-on-demand and network layer spoofing to move information optimally between central sites and dial-in users. WAN protocol support includes point-to-point protocol (PPP), Asynch-PPP and MultiLink-PPP. Robust security is provided via several mechanisms including PAP, CHAP, RADIUS, TACACS and Security Dynamic's ACE/SecurID.

The modules are hot swappable and auto-configurable to support mission-critical, on-demand networking. They are fully interoperable with remote site ISDN equipment.

Cabletron Systems (Rochester, N.H.)

Visit www. cabletron.com or Circle 203

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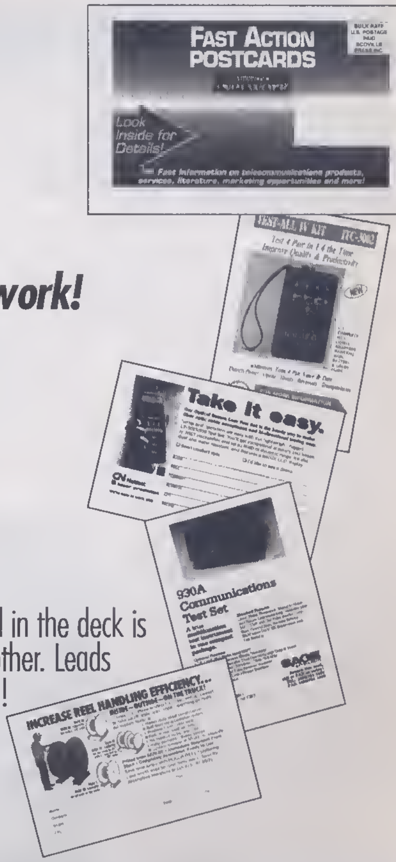

Wireline Products
continued

Channel bank modification

The Digroup Interface Unit (DIU) for 360 D4 channel banks eliminates false data readings occurring at the remote end of a T1 system while in alarm.

For a long time, the "garbage in/garbage out" effect has occurred at the remote-end channel bank of a T1 system during a yellow alarm condition. The yellow is accompanied by extraneous channel data transmitted from the distant end that is in red alarm. Extraneous random data is actually interpreted by the remote end, converted back into analog and forwarded to the end user. While this does not affect voice users, it creates problems for modem data users, especially if transactions were in progress at the time of failure.

In one case, users power was disconnected by the utility company because random data was interpreted as a disconnect order. These situations can now be avoided.

The DIU, which controls decoding of received data has been modified to inhibit received data to all channels during alarm conditions. Because some channel-bank applications do not require data inhibiting, technicians can use the former version of the DIU with full support.

Charles Industries Ltd. (Rolling Meadows, Ill.)

Visit www.charles.com or Circle 206

Low-traffic-density switching

The Access Node System (ANS) low-cost switching platform supports an extensive range of PSTN, ISDN and Intelligent Network Services (IN) service, and is designed for low-traffic-density where larger capacity exchanges may not be financially justifiable.

Network operators can buy what they need then add functionality as requirements change. For example, an installation could begin as a local exchange serving PSTN users; later, it could be reconfigured to include ISDN lines or it could become a traffic concentrator feeding into a larger AXE network.

The system can be deployed for small business and residential uses in rural or remote areas requiring a mix of PSTN, ISDN and IN services, or in busy metropolitan areas where extra capacity is needed quickly. ANS Local 1 is a complete local exchange in a single equipment cabinet. ANS Translocal 1, provides small networking solutions with the cost advantages of larger infrastructures, and can be configured as a local switch, an SSP, a transit exchange or any mix of the three.

Ericsson Network Systems (Richardson, Texas)

Call 972/583-1853 or Circle 204

Products and Services

DWDM for metropolitan service providers

GigaMux dense wavelength division multiplexers (DWDM) for metropolitan service providers accept any data format transparently. The system transforms existing fiber from a dedicated, single application into a versatile conduit capable of simultaneously transporting up to 16 independent optical channels, increasing total bandwidth from 2.5 Gbps to 40 Gbps. The system can be configured for simplex, full duplex or a combination of both operations.

Complete system management is provided through craft async, modem and Ethernet interfaces. Management protocol choices include Terminal, Telnet, SNMP, TFTP and ITU FTAM. The system also employs fully passive mux/demux modules, which increase reliability and provides an additional layer of protection for data traffic. Variations in temperature and power will not affect performance.

The system can span up to 80 km in its standard configuration. An enhanced system with an optical amplifier is available up to 120 km between nodes. Entry-level pricing starts at $35,000 for a single-channel configuration and $225,000 for the full 16-channel configuration.

Osicom Technologies Inc. (Santa Monica, Calif.)

Visit www.osicom.com or Circle 208

Billing platform

The Sterling 5005 platform for downstream data gathers application-specific data from the Sterling Host Collector via 802.3 LAN or optional fiber distributed data interface (FDDI). The Sterling 5005 provides this data in a secure environment while maintaining the integrity of the billing data stream.

The system features 384 MB of total RAM and 2 GB internal storage, with additional 2 GB internal storage.The Sterling Message Detail Recording (SMDR) application for the Sterling 5005 platform collects and centralizes call screening and message detail recording outputs of specialized processing modules from multiple Sterling 5000s. It segregates data; provides a single source and format of data, even when end users are served by more than one switch; provides non-volatile storage for SMDR data, and delivers SMDR data to CPE processing.

Axiom Inc. (Moorestown, N.J.)

Call 609/866-1000 or Circle 210

Products and Services
continued

Mainframe OTDR tester

The HP E3424A dynamic range module gives a higher installation and maintenance measurement resolution when used with the HP 8147 optical time domain reflectometer (OTDR). Technicians can measure significantly longer fiber links in a single test. It delivers a guaranteed dynamic range of more than 42dB at 1310 nm wavelength and 20 microseconds pulse (usec) width. At 1550 nm wavelength, 41dB can be achieved. This provides longer measurement range in field testing resulting in reduced cost at higher measurement resolutions.

The dynamic range module provides improved fiber and event characterization even at pulse widths under 1 usec, where it eliminates the "ripple-on-trace" effect caused by polarization properties of the test set-up.

Hewlett Packard Co. (Palo Alto, Calif.)

Visit www.hp.com/go/tmdir or Circle 211

Wire connector

The P-Conn Shark screw-on wire connector has comfortable grip fins running the length of the barrel, combining fins with deep contoured ribs for improved gripping ability and comfort.

The connector features a "live" expanding spring to bite and hold wires securely. Three sizes cover the range of typical applications: Yellow Shark PF1 for two #20 wires through three #12 wires; Red Shark PF2 for three #22 wires through five #12 wires; and Blue Shark PF4 for one #12 wire plus one #14 wire through one #6 wire plus two #8 wires. The design is UL-listed and CSA-certified for use up to 600V maximum for building wire and 1000V maximum for signs, fixtures and luminaries.

The connector's tough nylon housing resists breakage and provides electrical insulation at 105° C. A funnel entry guides wires into the connector to speed termination on solid and stranded copper wire. A deep skirt provides protection from flashover and shorts.

Panduit Corp. (Tinley Park, Ill.)

Call 800/777-3300 or Circle 209

New product information should be submitted to Debbie Sklar, Solutions editor, at *America's Network*, **714/513-8698; Fax: 714/513-8634 • dsklar@americasnetwork.com**

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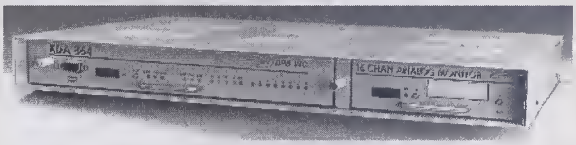
Network Visibility for Older Non-intelligent Equipment

If monitoring alarms are important to your business but you have older, non-intelligent equipment, DPS has the solution to your problem without having to go to the expense of replacing your existing equipment.

The KDA 864-SNMP Alarm Remote allows you an easy way to report such events as: intrusion, high/low temperature and equipment failure to your existing SNMP management platform. It's a great way to give network visibility to your older, non-intelligent equipment.



Base unit supports 64 alarm inputs and has 8 relays to control external devices. Additional units may be cascaded for more capacity.

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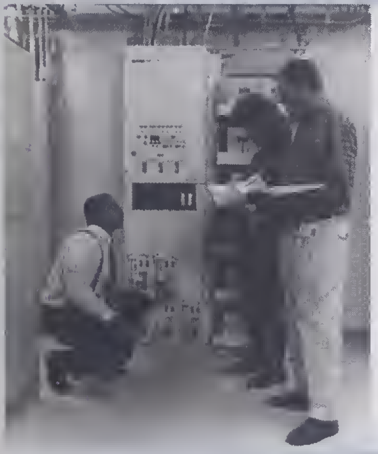

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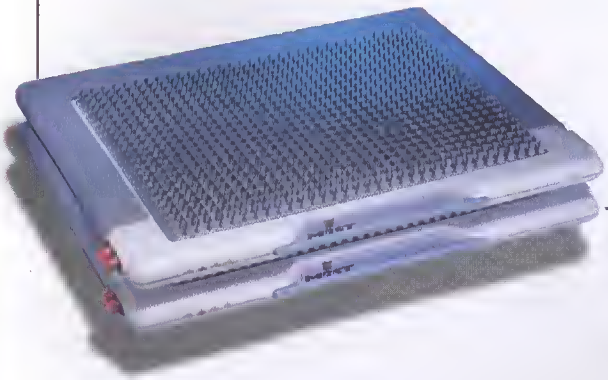

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ART BROTHERS

The cost doctors

FCC alchemists concoct 'rate prescriptions.'

In an interesting Federal Communications Commission order to see the light of day in 1998, the FCC Common Carrier Bureau used National Carrier Exchange Association (NECA) data to compare switching costs of 55 telcos serving from 800 to 1,000 subscribers from one or two exchanges.

Any charges over the FCC Common Carrier Bureau's rate cap will be disallowed and rate income using true costs will be found unlawful.

From those reported costs, the bureau developed a ratio of total operating expense to plant in service (TPIS). The average ratio was 22%. The bureau thus intends to establish a "rate prescription" for local switching. The cap will be a TPIS of 25%. Any charges over this amount will be disallowed. Income from rates using true costs will be found unlawful, and any earnings for costs over the ratio will be required to be refunded with interest compounded daily.

The first telco to be so effected has 900 customers grouped around 15 exchanges. There is 600 route miles of toll just to get to and from those exchanges. Moreover, it appears the bureau is not going to allow the telco's leased switched expenses.

So unless you buy it—it doesn't exist. Leased switching expenses are to be disallowed. My analysis found some companies with ratios as high as 100%. I was unable to tell if higher ratios reflect leased switching expenses. There is a fear in some quarters that these new rules come from economics types who think the industry is like peas in a pod and all independents are tidy little companies with identical costs. Is the FCC switching us to the same track as was last seen by Western Union? Sure and a good New Year to you all!

MISCELLANEOUS

Sales of debit cards are a fast-moving item in every 7-11 convenience store. So say the clerks I ask. And when those promotional cards reach their allotted 10- or 15-minute time limit—there is no warning, just disconnect—click. Unless you call and use you credit card to get the debit card "recharged."

If Delta Airlines has a mechanical or weather problem that disrupts a regular schedule, the counter agents are authorized to give free debit cards so you can phone home.

And you are not supposed to convert a business phone used for validation of credit cards to a public coin(less) line to enable billing 27 cents a call to the validation 800 number.

And why should Southern New England Telephone (SNET) make a killing on surcharges to telcos for validation of VISA cards, just because VISA won't deal with any other telco except SNET? Alan said it appeared there was an anti-trust issue there somewhere.

FLOWERS TO THE NEVADA PSC!

In the normal Levi's-and-plaid-shirt dress anywhere else—over the Christmas vacation, they managed in the last two days to have non-stop (unopposed) hearings to ram through dozens of universal service fund eligibility approvals with other related items for that state's rural telcos.

Jim Bull phoned me many years ago. The Grass Valley guys in California had completed a video switch for NASA, but could not figure out how to move it. Seems it was big, and could not be disassembled. Humor had the guys saying to NASA to send out a big rocket and they could deliver it in 20 minutes or so, but it would be freight on board. I allowed how we move big things like that on a cushion of air. One or two guys can shove big, heavy switches from loading docks to air ride trucks.

What got me thinking about Jim was the two 768-port video switches Bally's casino in New Jersey installed to switch some of the thousands of video cameras in their complex. The casino doesn't have tel or data twisted pair or coax for anything except plain old telephone service (POTS). The major runs of the 1,500 miles of fiber are in 36 fiber bundles. Every gaming table, security camera and wideband data device has fiber. Fiber runs though the place like conventional 25-pair station wire, only each bundle has 36 fibers. This is called planning for the future. Could your telco handle installation or maintenance of diverse stuff like this? Do you want to?

How about schools, library and telemedicine transport and local termination. Do you know the difference between high resolution video and how to handle or switch it.

And, where do we get the trained tech's that know how to plan, install, and maintain this new telecommunications stuff? ■

When Art Brothers isn't choking down strong, FCC medicine, he's chief surgeon at Beehive Telephone Co. and can be reached at artb@beehive.net

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